PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

Edited and Issued Monthly by

THE INSTITUTION OF ELECTRICAL ENGINEERS

In Association with

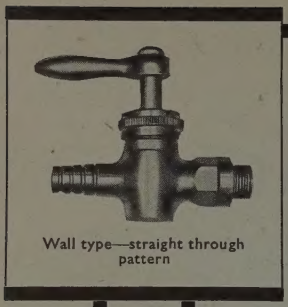
THE PHYSICAL SOCIETY

THE AMERICAN PHYSICAL SOCIETY

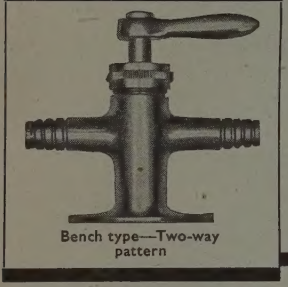
THE AMERICAN
INSTITUTE OF ELECTRICAL ENGINEERS

ABSTRACTS 2658-2958

VOLUME 48 **NOVEMBER 1945** NUMBER 575



Wall type—straight through pattern



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061.3 : 535.33 *see Abstr.* 2888

378 : 727 : 621.317.2 : 53 *see Abstr.* 2730

511.213 2658

Bertrand's postulate. PILLAI, S. S. *Bull. Calcutta Math. Soc.*, 37, *p.* 27, *March*, 1945.—A correction to previous work [Abstr. 1176 (1945)]. L. S. G.

511.22 : 511.47 2659

On the application of the congruence property of Ramanujan's function to certain quaternary forms. BANERJEE, D. P. *Bull. Calcutta Math. Soc.*, 37, *pp.* 24–26, *March*, 1945.—Some new congruence relations satisfied by Ramanujan's function are proved and applied to some congruence properties of the quaternary forms: (A) $4n = a_1^2 + a_2^2 + a_3^2 + a_4^2$, where $a_1, \ldots, a_4$ are positive odd integers; (B) $8n = \sum_{r=1}^{8} a_r^2$, where $n, a_1, \ldots, a_8$ are positive odd integers; (C) $2n = a_1^2 + a_2^2$, where a_1, a_2, n are positive odd integers; (D) $4n = a_1^2 + \ldots + a_4^2 + du^2$, where $n, u, a_1, \ldots, a_4$ are positive odd integers. L. S. G.

511.42 2660

The minima of a pair of indefinite, harmonic, binary quadratic forms. OLLERENSHAW, K. *Proc. Camb. Phil. Soc.*, 41, *pp.* 77–96, *June*, 1945.—The forms $f_1 \equiv a_1x^2 + 2b_1xy + c_1y^2$ and $f_2 \equiv a_2x^2 + 2b_2xy + c_2y^2$ are such that $d_1 \equiv b_1^2 - a_1c_1 > 0$, $d_2 \equiv b_2^2 - a_2c_2 > 0$ and $a_1c_2 - 2b_1b_2 + c_1a_2 = 0$. By $\kappa(f_1, f_2)$ we mean the minimum of max.$(|f_1|, |f_2|)$ taken over all integer values of x and y not both zero. It is shown that $\kappa(f_1, f_2) \leqslant k(d_1, d_2)$ where k is a multiple of either $\sqrt{d_1}$ or $\sqrt{d_2}$ according to the value of d_1/d_2, and this is a best possible result. This means the best possible number k, independent of x and y, is found such that there exist integers not both zero for which $|f_1| \leqslant k$, $|f_2| \leqslant k$. Pairs of forms are found for which max. $(|f_1|, |f_2|) = k$. The method involves the use of some properties of the critical lattices of the domain defined by $|xy| \leqslant 1$, $|x^2 - y^2| \leqslant 2\mu$ where $\mu \equiv \sqrt{(d_1/d_2)}$. L. S. G.

511.47 : 511.22 *see Abstr.* 2659

511.53 2661

On the equation $2^x - 3^y = 2^X + 3^Y$. PILLAI, S. S. *Bull. Calcutta Math. Soc.*, 37, *pp.* 15–20, *March*, 1945.—All the solutions of the equations $2^x - 3^y = 3^Y - 2^X$, $2^x - 3^y = 2^X + 3^Y$ and $3^y - 2^x = 2^X + 3^Y$ are found (by elementary methods). The results are I. 1, 5, 7 and 23 are the only positive numbers simultaneously expressible in the forms $2^x - 3^y$ and $3^Y - 2^X$. The representations are $1 = 3 - 2 = 3^2 - 2^3 = 2^2 - 3$; $5 = 3^2 - 2^2 = 2^3 - 3 = 2^5 - 3^3$; $7 = 3^2 - 2 = 2^4 - 3^2$; $23 = 2^5 - 3^2 = 3^3 - 2^2$. II. 5, 7, 13, 29 and 247 are the only solutions of $2^x - 3^y = 2^X + 3^Y$, thus: $5 = 2 + 3 = 2^3 - 3 = 2^5 - 3^3$; $7 = 2^2 + 3 = 2^4 - 3^2$; $29 = 2 + 3^3 = 2^5 - 3$; $13 = 2^2 + 3^2 = 2^4 - 3 = 2^8 - 3^5$; $247 = 2^2 + 3^5 = 2^8 - 3^2$. III. 5, 7, 11, 17, 19, 25, 65 and 73 are the only solutions of $3^y - 2^x = 2^X + 3^Y$. The representations are similarly given. L. S. G.

511.53 : 519.48 2662

On the number of solutions of certain non-homogeneous trinomial equations in a finite field. VANDIVER, H. S. *Proc. Nat. Acad. Sci., Wash.*, 31, *pp.* 170–175, *June*, 1945.—The method used in a previous paper [Abstr. 1180 (1945)] is now used to find expressions for the number of solutions (u^e, v^f, w^g) of the equation $au^e + bv^f + w^g = 0$, and the number of solutions (u^e, v^f) of $au^e + bv^f + 1 = 0$, in a finite field F, of order p^n (p a prime). As an application the number of sets of distinct solutions (x^4, y^2) of $ax^4 + by^2 + 1 \equiv 0 \pmod{p}$ is determined. L. S. G.

512.83 : 621.396.611.3.018.41 ≙ 4 2663

Application of three types of determinants to the calculation of the natural frequencies of coupled oscillating systems. VAULOT, A. E. *Rev. Gén. Élect.*, 48, *pp.* 352–353, *Dec.*, 1940.

513.614 2664

On multiple curves. I–II. HODGE, W. V. D. *Proc. Camb. Phil. Soc.*, 41, *pp.* 111–126, *June*, 1945.—The image of an involution I_n, of order n, on an irreducible variety, Γ, of dimension d, is a variety C, also irreducible and of dimension d. Γ is said to be a multiple of C and the special case considered is where Γ and C are curves ($d = 1$) and the involution I_n is such that it is unramified and is generated by an Abelian group G of order n of birational transformations of Γ into itself. The relation between the Riemann surfaces of Γ and C is discussed and this provides a basis for the discussion of the topology of Γ. Some special cases studied are those where G is generated by one generator (G is then cyclic) or by two generators. In II the Abelian integrals of the first kind on Γ are considered, including the case where Γ is hyperelliptic. An example is given relating to a curve Γ of genus 5 which contains an involution of order 4 without ramification. L. S. G.

513.712.7/.8 2665

Covariant line complexes of a pair of quadric surfaces. TODD, J. A. *Proc. Camb. Phil. Soc.*, 41, *pp.* 127–135, *June*, 1945.—There are 16 covariant line complexes, 8 of the second order and 8 of the third. The geometrical relations existing between these are discussed systematically, and the syzygies which exist between the complexes are obtained explicitly. A matrix notation is used throughout the paper rather than the symbolic notation. L. S. G.

513.728 : 513.83 2666

Point-curve correspondences. I. The theory of the base. SCOTT, D. B. *Proc. Camb. Phil. Soc.*, 41, *pp.* 135–145, *June*, 1945.—Some general results are given for point-primal correspondences. Some lemmas on Riemann matrices are obtained and used in the derivation of the base for point-curve correspondences between two surfaces. L. S. G.

513.813 : 517.947.44 : 535.13 *see Abstr.* 2855

513.83 : 513.728 *see Abstr.* 2666

515.53 : 519 2667

Use of stereographic projection for statistical problems. BURT, C. *Nature, Lond.*, 156, *p.* 338, *Sept.* 15, 1945.

517.2 : 519.53 2668

A general form of the covering principle and relative differentiation of additive functions. BESICOVITCH, A. S. *Proc. Camb. Phil. Soc.*, 41, *pp.* 103–110, *June*, 1945.—Vitali's covering principle, which was originally concerned with n-dimensional Lebesgue measure in n-dimensional space, is extended to any non-negative additive function. Given a plane set G and a set Γ of circles in the same plane, such that to each point x of G there corresponds circles of Γ of centre x and of arbitrarily small radius, we say that Γ covers G in the Vitali narrow sense. With this definition the following theorem is proved: If $F(X)$ is a non-negative additive function of a set X of an additive class C, equal to 0 for any set X outside a set G of C, and if a set Γ of circles covers G in the Vitali narrow sense, then Γ contains a subset Γ^* of non-overlapping circles such that $F(\Gamma^*) = F(G)$. This theorem is applied to the problem of relative differentiation. L. S. G.

517.23 2669

On the inequality satisfied by the derivative of order n of a function. SIRCAR, H. *Bull. Calcutta Math. Soc.*, 37, *pp.* 21–23, *March*, 1945.—An inequality is deduced for the lower bound of $|f^{(n)}(x)|$ in (a, b) where $f(x)$ is defined in (a, b). This is related to a normalized orthogonal system of functions in (a, b). Three examples are given, concerning the Tschebyscheff, Legendre and Laguerre polynomials respectively. L. S. G.

517.27 2670

On the differentiability of monotone functions. SHUKLA, P. D. *Bull. Calcutta Math. Soc.*, 37, *pp.* 9–14, *March*, 1945.—Necessary and sufficient conditions are found in order that a differential coefficient exist, and in this case the value of the coefficient is deduced. One of the theorems proved is: If $P(x)$ is a monotone non-decreasing and continuous function of x in any interval $(0, \alpha)$ with $P(0) = 0$, then the necessary and sufficient condition for the existence of $P'_+(0)$ is that $\lim_{r\to\infty} P(x_r)/x_r$ exists, where $\{x_r\}$ is a sequence of positive values of x having the limit zero, provided $\lim_{r\to\infty} x_{r+1}/x_r = 1$. L. S. G.

517.37 2671

A certain multiple integral. SIMPSON, H. *Phil. Mag.*, 36, *p.* 224, *March*, 1945.—The integral [Abstr. 780 (1945)] is evaluated very quickly by two methods, one of which involves the elementary theory of probability. L. S. G.

517.392 2672

Coefficients for mid-interval numerical integration with central differences. SALZER, H. E. *Phil. Mag.*, 36, *pp.* 216–218, *March*, 1945.—The numerical values of the coefficients are given and these permit the use of the first Gaussian summation-formula with central differences up to the 49th order. The coefficients were discussed in a recent paper [Abstr. 1930 (1944)]. L. S. G.

517.41 2673

A theorem on functional determinants. LIEBOWITZ, B. *Phys. Rev.*, 68, *pp.* 53–54, *July* 1 *and* 15, 1945.—A proof is given of a theorem used in a previous paper [Abstr. 1238 (1945)]. L. S. G.

517.512.2 2674

On Fejér's calculation of the Lesbesgue constants. LORCH, L. *Bull. Calcutta Math. Soc.*, 37, *pp.* 5–8, *March*, 1945.—An elementary calculation of the constants is made. The gamma function, used by Fejér, is not needed now so that the calculation of the Lesbesgue constants for Borel summability is also placed on an elementary level. L. S. G.

517.512.2 : 621.3.012 2675

The Fourier integral as an engineering tool. CARLIN, H. J. *Radio-Electronic Engng*, 4, *pp.* 16–18, 20, 22 *and* 30–31, *June*, 1945.—It is shown that Fourier analysis may be used to calculate over-all circuit performance, rather than just to analyse given wave shapes into harmonics. Some simple examples are given of the directness of the Fourier Integral method in solving circuit problems. L. S. G.

517.522.3 2676

On the summation of certain trigonometric series. GODDARD, L. S. *Proc. Camb. Phil. Soc.*, 41, *pp.* 145–160, *June*, 1945.—The series

$$S_n^t(\alpha) = \alpha^2 n^2 \sum_{m=1}^{\infty} \frac{\sin^2(\pi m/\alpha)}{m^t(m^2 - \alpha^2 n^2)},$$

$$T_n^t(\alpha) = \alpha^2 n^2 \sum_{m=1}^{\infty} \frac{\sin^2(\pi m/\alpha)}{m^{t-2}(m^2 - \alpha^2 n^2)^2}$$

where $\alpha > 1$, $t = 1, 2, 3, \ldots$ and n is a positive integer, are summed, in closed form, in terms of $S_n^1(\alpha)$, $S_n^2(\alpha)$, $T_n^1(\alpha)$, $T_n^2(\alpha)$ and the series $\Theta_k(\alpha)$ $(k = 1, 2, \ldots, t)$ where $\Theta_k(\alpha) = \sum_{m=1}^{\infty} [m^{-k} \sin^2(\pi m/\alpha)]$. The expressions obtained are suitable for computing the sums and tables of values are given. The results of a previous note are generalized [Abstr. 13 (1944)]. The following integral formulae are derived:

$$-S_n^1(\alpha) = \alpha^{-1} \int_0^{\pi} \sin^2 n\chi \cot(\chi\alpha^{-1}) d\chi,$$

$$n^{-1}T_n^1(\alpha) = \tfrac{1}{2}\alpha^{-1} \int_0^{\pi} (\pi - \chi) \sin 2n\chi \cot(\chi\alpha^{-1}) d\chi - \tfrac{1}{4}\pi^2\alpha,$$

and from these asymptotic series, for large α, are derived. It is shown, by contour integration, that

$$S_n^1(\alpha) = -\tfrac{1}{2} \int_0^{\infty} \frac{\cosh \pi n\alpha\xi - \cosh \pi n(\alpha - 2)\xi}{\sinh \pi n\alpha\xi} \frac{d\xi}{\xi(1 + \xi^2)}$$

For an application of the series to an electromagnetic problem see Abstr. 2658 B (1945)]. L. S. G.

517.53 : 621.392.1 : 534.13 *see Abstr.* 2837

517.544.2 : 537.222 : 537.213 *see Abstr.* 3008

517.564 2677

On the integrals $\int_0^x J_k(x)dx$ and $\int_0^x J_{-k}(x)dx$. SIRCAR, H. *Bull. Calcutta Math. Soc.*, 37, *pp.* 1–4, *March*, 1945.—Various integral formulae are obtained for the two integrals, denoted by $S_k(x)$ and $S_{-k}(x)$ respectively, e.g.

$$S_k(x) = (k-m) \int_0^x y^{-1} J_{k-m}(y) S_m(x-y) dy, \quad k - m > 0.$$

Among various integrals evaluated are

$$\int_0^\infty \{S_{-k}(x) - S_k(x)\}x^{-1}dx \text{ and } \int_0^\infty x^{-s+1}S_k(x)dx$$

where $0 < k < 1$ in the first integral and $k > s - 1$ (s being a positive integer) in the second. L. S. G.

517.564.3 2678

Notes on the evaluation of zeros and turning values of Bessel functions. I. Introductory. BICKLEY, W. G., AND MILLER, J. C. P. *Phil. Mag.*, 36, *pp.* 121–124, *Feb.*, 1945.—The present series of notes gives an account of the problems encountered in recent years in the computation of the zeros, turning values, and related numbers of the J_n and Y_n functions of orders other than 0 and 1. As n increases, a gap between the zeros obtainable by inverse interpolation and by the McMahon expansion (the two standard methods) appears and widens and work now recorded helps considerably in reducing this gap. L. S. G.

517.564.3 2679

Notes on the evaluation of zeros and turning values of Bessel functions. II. The McMahon series. BICKLEY, W. G., AND MILLER, J. C. P. *Phil. Mag.*, 36, *pp.* 124–131, *Feb.*, 1945.—The range of usefulness of the McMahon expansion is increased by the calculation of three terms additional to those given in Watson's "Theory of Bessel Functions." Tables of the coefficients are given and these facilitate the computation of the zeros. L. S. G.

517.564.3 2680

Notes on the evaluation of zeros and turning values of Bessel functions. III. Interpolation by Taylor series. BICKLEY, W. G. *Phil. Mag.*, 36, *pp.* 131–133, *Feb.*, 1945.—The method of interpolating by Taylor series is applicable over a wide interval and is illustrated by the evaluation of the second zero of $J_{20}(x)$ at $x = 29{\cdot}961603\ldots$. Thirteen decimals are retained in the calculation. L. S. G.

517.564.3 2681

Notes on the evaluation of zeros and turning values of Bessel functions. IV. A new expansion. MILLER, J. C. P., AND JONES, C. W. *Phil. Mag.*, 36, *pp.* 200–206, *March*, 1945.—The new method is as follows: let

$$p = \frac{1}{x}\frac{J_n(x)}{J_{n-1}(x)},\quad q = \frac{1}{x}\frac{J_n(x)}{J_{n+1}(x)},\quad h = x_0 - x,\quad r = h/x,$$

where $x = x_0$ is the zero of $J_n(x)$ and $x = x_1$ is a known approximation to x_0. The function r is developed as a power series in p and in q (the coefficients being functions of x) thus:

$$r = -p[1 + (2n-1)p/2 + \{(2n-1)(4n-1) - 2x_1^2\}p^2/6 + \ldots],$$

$$r = q[1 + (2n+1)q/2 + \{(2n+1)(4n+1) - 2x_1^2\}q^2/6 + \ldots].$$

By substituting $x = x_1$ in either series the value of x_0 may be calculated since $x_0 = x(1 + r)$. By this method the McMahon series for $n = \frac{3}{2}$ and $n = \frac{5}{2}$ are found. As an example of the method the fifth zero of $Y_4(x)$ at $x = 19{\cdot}2244289\ldots$ is found. L. S. G.

517.564.3 2682

Notes on the evaluation of zeros and turning values of Bessel functions. V. Checks. BICKLEY, W. G., AND MILLER, J. C. P. *Phil. Mag.*, 36, *pp.* 206–210, *March*, 1945.—A number of checks are based on the existence of the double sequence of zeros, $j_{n,s}$ and $y_{n,s}$, ordered as regards both n and s. These checks are described and examples of their use are given. They extend the scope of the method of checking by differences. L. S. G.

517.564.3 : 621.396.616 : 621.385.8 : 538.56 *see Abstr.* 3062

517.942.82 : 536.212 *see Abstr.* 2971

517.947.44 : 513.813 : 535.13 *see Abstr.* 2855

517.948.33 : 530.145 2683

Approximate solutions of the integral equations in scattering problems. HSÜEH, C. F., AND MA, S. T. *Phys. Rev.*, 67, *pp.* 303–307, *May* 1 *and* 15, 1945.—The integral equations occur in the theory of the influence of radiation damping on scattering processes in quantum theory [Abstr. 1993 (1944), 2834 (1943), 2852 (1934)], and an approx. method for solving the equations is given which is similar to the variational method often used in atomic physics. The accuracy of the approx. is tested by means of 3 examples, for each of which an exact solution is known. These are (i) non-relativistic scattering of a light quantum by an electron at rest, (ii) scattering of a positive meson by a neutron, and (iii) scattering of a negative meson by a proton. L. S. G.

518 : 535.33–15 *see Abstr.* 2889

518.5 2684

Differential analyser applications. MAGINNISS, F. J. *Gen. Elect. Rev.*, 48, *pp.* 54–59, *May*, 1945.—Typical examples are given of the wide variety of problems that have been successfully dealt with by means of the G.E.C.'s differential analyser. Problems involving non-linear, experimental or discontinuous functions and field plots may be handled by the analyser with relative ease. The examples given include (1) the determination of compressible flow fields for a fluid flowing round various types of obstacles; (2) the transient performance of induction motors; (3) landing shock effects on an aeroplane; (4) supercharging of a 2-cycle Diesel engine; (5) torsional-oscillation problems involving non-linear springs; and (6) factors affecting the voltage recovery of a synchronous machine after a disturbance. A useful bibliography is appended. A. W.

518.5 : 621.314.212.017.7 2685

Ageing of transformer insulation computed. PRATT, M. H. *Elect. World, N.Y.*, 124, *pp.* 79–81, *Sept.* 1, 1945.—[Abstr. 2465 B (1945)].

519 : 515.53 *see Abstr.* 2667

519.2 : 535.13 *see Abstr.* 2856

519.2 : 621.317 2686

The fixing of confidence limits to measurements. JOSEPHS, H. J. *J. Instn Elect. Engrs*, 92, *Part II*, *pp.* 194–213, *June*, 1945.—The idea of significance testing underlies most practical applications of probability theory to electrical measurements. Problems involved in the application of simple tests of significance to small sets of measurements are discussed. The w-test, designed to apply to normally distributed variables, and the t-test, of particular use in dealing with a small number of observations, are described. A method of rapidly applying the latter test is given, and it is shown that if the true mean

value of a physical quantity is unknown the confidence limits to be attached to an estimated value obtained from the measurements may be easily determined. A rapid method of estimating the standard deviation of a set of measurements is described; it is shown that for very small samples the extreme-mean or median forms a good alternative to the arithmetic mean and is often easier to calculate. Pearson's χ^2-test of goodness-of-fit is explained and illustrated. Emphasis is placed on the flexible nature of this test and its relationship to the *w*-test.

519.21 : 542.61 : 532.73 *see Abstr.* 2808

519.214 2687

Chance effects and the Gaussian distribution. HALDANE, J. B. S. *Phil. Mag.*, 36, *pp.* 184–185, *March*, 1945.—The subject considered is that of an earlier paper [Abstr. 75 (1945)], where the function, $p_n(x)$, is of central importance. The general formula for $p_n(x)$ is now given and this formula gives rise to a frequency curve (consisting of a series of arcs of algebraic curves) which, as n increases, approximates very closely the normal curve. The closeness of the approximation is examined, a frequency function of the Gram–Charlier type A series being obtained.

L. S. G.

519.271.3 2688

Inverse binomial sampling. CASE, R. A. M. *Nature, Lond.*, 156, *p.* 115, *July* 28, 1945.

519.271.3 2689

Economy in sampling. BARNARD, G. A. *Nature, Lond.*, 156, *p.* 208, *Aug.* 18, 1945.—[See Abstr. 1644 (1945)].

519.283 2690

Distribution of wars in time. RICHARDSON, L. F. *Nature, Lond.*, 155, *p.* 610, *May* 19, 1945.

519.283 : 620.113 : 621.791.76 2691

Application of quality control to resistance welding. HOBSON, L. S., INGLIS, R. S., AND MCCANTS, R. P. *Trans. Amer. Inst. Elect. Engrs*, 64, *pp.* 573–575, *Aug.*, 1945.—[Abstr. 2708 B (1945)].

519.283 : 523.746 *see Abstr.* 2698

519.283 : 620.113 2692

Statistical methods in quality control. II. Two kinds of measurement—variables and attributes. III. Frequency distribution for set-up check of process. IV. Sub-grouping of data-finding causes of trouble. *Elect. Engng, N.Y.*, 64, *pp.* 249–250, *July;* 299–300, *Aug., and pp.* 328–329, *Sept.*, 1945.—[See Abstr. 1646 (1945)].

519.41 2693

Groups having a small number of sets of conjugate subgroups. MILLER, G. A. *Proc. Nat. Acad. Sci., Wash.*, 31, *pp.* 147–150, *May*, 1945.—Firstly a classification is made of groups which do not contain more than 4 sets of conjugate subgroups. Next it is shown that the only prime power non-cyclic group which contains as few as five sets of conjugate subgroups is the four group. Also, if a prime power group contains exactly 6 sets of conjugate subgroups it may be the group of order p^5, p being an arbitrary prime number, the quaternion group, or the non-cyclic group of order 9. The possible cases are considered where the group contains exactly 6 sets of conjugate subgroups but its order is not a power of a prime number. [See Abstr. 1220 (1945)]. L. S. G.

519.44 269

Illustrations and simple abstract proof of Sylow's theorem. MILLER, G. A. *Proc. Nat. Acad. Sci. Wash.*, 31, *pp.* 166–170, *June*, 1945.—The theorem proved is: if the order of a group G is divisible by p^m, p being a prime, but not a higher power of p, then G contains at least one subgroup of order p^m and if it contains more than one such subgroup all of these subgroups are conjugate under G and their number is of the form $1 + kp$. The proof is in two parts according as G is Abelian or not. L. S. G.

519.48 : 511.53 *see Abstr.* 2662

519.52 269

Totally heterogeneous continua. BESICOVITCH, A. S. *Proc. Camb. Phil. Soc.*, 41, *pp.* 96–103, *June*, 1945.—The continua are defined and their existence is established. The solution is obtained by considering a special class of continua called dendrites which are locally connected continua of which no Jordan curve is a subset. L. S. G.

519.53 : 517.2 *see Abstr.* 2668

521.389 : 532.137 *see Abstr.* 2780

523.11 269

A new approach to relativistic cosmology. INFELD, L. *Nature, Lond.*, 156, *p.* 114, *July* 28, 1945.—A statement of conclusions reached by considering a line element which is more general than is usual in the kinematical parts of relativistic cosmology.

523.4 : 523.75 *see Abstr.* 2699

523.4 : 535.33 269

Spectra of the planets. BOBROVNIKOFF, N. T. *Rev. Mod. Phys.*, 16, *pp.* 271–285, *July–Oct.*, 1944.—Surveys the information available on the spectra of the various planets and discusses the physical conditions on the surfaces of these planets in the light of this information. In discussing the absorption spectra only rotational-vibrational spectra of polyatomic molecules are considered. A. F.

523.6 : 523.841.11 : 523.752 *see Abstr.* 2701

523.67 : 523.872 : 535.338.4 *see Abstr.* 2904

523.72 : 621.396.822 : 535.232 *see Abstr.* 2861

523.746 : 519.283 269

A forecast of solar activity. GLEISSBERG, W. *Nature, Lond.*, 156, *p.* 539, *Nov.* 3, 1945.—[See Abstr. 81 (1944)].

523.75 : 523.4 269

Planetary and solar observations on the Pic du Midi in 1941, 1942 and 1943. LYOT, B. *Astrophys. J.*, 101, *pp.* 255–259, *March*, 1945.—The work summarized includes: coronagraph moving pictures through a polarizing monochromator isolating the red and green coronal lines; chromospheric films of prominences and flares in $H\alpha$; direct films in integrated light of the solar granulation; photometric work on the corona; and both visual and photographic observations of Mars, Mercury, Jupiter's satellites, Saturn and the Moon. A. HU

523.752 270

A preliminary report on chromospheric spicules of extremely short lifetime. ROBERTS, W. O. *Astrophys. J.*, 101, *pp.* 136–140, *March*, 1945.—A coronagraph is used in conjunction with an interference polarization monochromator to investigate in $H\alpha$ ligh

small-scale chromospheric structure near the sun's poles. Small spikes of lifetime 4–5 min., of low brightness, and of max. height 15″ are present at all times and move upwards in the solar atmosphere at 30 km/sec. Possible associations with the coronal plumes which appear on eclipse photographs at solar min., and with the rice grains of the disk, are discussed. A. HU.

523.752 : 523.6 : 523.841.11 2701

The activities of the Meudon Observatory since 1940. D'AZAMBUJA, L. *Astrophys. J.*, 101, *pp.* 260–261, *March*, 1945.—Brief results are given of a systematic study of the evolution and bodily movement of prominences observed as dark filaments on the solar disk. The internal motions are not found to conform to Pettit's laws. Photometric and spectrographic observations of comets, novae, and supernovae are briefly reported. A. HU.

523.755 2702

Recent progress in astrophysics: M. Waldmeier's work on the corona. DEUTSCH, A. J. *Astrophys. J.*, 101, *pp.* 117–130, *Jan.*, 1945.—A full summary of coronal research carried out during the war at Arosa, Switzerland. The observations are made for the most part with a coronagraph, and are concerned with photometry of the inner corona in white light; intensity distribution of coronal emission lines at the limb; regions of coronal activity and their relation to spot zones and geomagnetism; and contours of λ5303 at different distances from the limb. A. HU.

523.775.5 : 535.338.3 2703

On the excitation of the coronal lines. HUANG, K. *Astrophys. J.*, 101, *pp.* 187–195, *March*, 1945.—The theory of intermediate couplings is used in conjunction with the observed multiplet separations to derive the transition probabilities of the coronal lines, and thence via the observed intensities to obtain the concentrations of the emitting ions. The excitation mechanism suggested by these concentrations is that of inelastic collisions with electrons of energy corresponding to temperatures >20 000°K. A lower limit for the cross-section of the collision process is derived. A. HU.

523.802 : 523.852.32 *see Abstr.* 2716

523.821.3 : 523.899 2704

McCormick photovisual sequences. WIRTANEN, C. A., AND VYSSOTSKY, A. N. *Astrophys. J.*, 101, *pp.* 141–178, *March*, 1945.—A network of 329 photovisual magnitude sequences, each containing about 13 stars of mag. 6·3 to 10·5, covering the sky from +75° to −15° has been established by direct comparison with the polar sequence on a Cooke 10-in. camera. The accuracy of the individual magnitudes is not particularly high (±0·075 mag.), but the observational method was directed to linking the system closely to the international photovisual system. Internal probable errors are determined from repeated observations, and comparisons are given with 4 other catalogues. A. HU.

523.821.5 : 523.841.372.4.035.92 *see Abstr.* 2708

523.823.5 : 523.899 2705

Colour indices of proper-motion stars. LUYTEN, W. J., JOSE, P. D., AND FOSTER, J. F. *Astrophys. J.*, 101, *pp.* 87–94, *Jan.*, 1945.—Colour indices are given for 309 stars of annual proper motion betw. 0·2″ and 0·5″. Ten are selected as much whiter than expected: such of these as are not M dwarfs situated in obscured regions are probably white dwarfs or "intermediates." A. HU.

523.84.035.94 : 523.841.374 2706

The period-luminosity and the period-spectrum relations of cluster-type Cepheids. PIŞMIŞ, P. *Astrophys. J.*, 101, *pp.* 204–207, *March*, 1945.—From observations of 43 cluster-type variables in the globular cluster M3, diagrams showing the period-colour and period-luminosity relations are constructed. The first is similar to that of classical Cepheids; the second is the reverse, the period increasing with decreasing luminosity. The colour-luminosity diagram shows a descending branch similar to that of the main sequence. This characteristic, combined with the period-density relation given by the pulsation theory, would be expected to produce the observed results. A. HU.

523.841.11 : 523.6 : 523.752 *see Abstr.* 2701

523.841.35 2707

Spectrophotometry of Mira Ceti. SCOTT, R. M. *Astrophys. J.*, 101, *pp.* 71–86, *Jan.*, 1945.—Fourteen calibrated objective-prism spectra of this variable at phases between 0 and 0·6 are examined for variation of continuous background, of band absorption, of Ca absorption lines and of H emission lines. The variation of intensity at 4 150 Å is that to be expected from a black body whose temperature and radius change by the expected amounts. The observed magnitude variation is due to a variation of selective absorption (lines and bands) and not to non-selective veiling. The range of ionization in Ca greatly exceeds the temperature range, and is represented by a variation of logarithmic electron pressure from −2·34 at max. to −7·73 at min. The H emission originates below the Ca absorption, the intensity of Hε being that predicted by assuming a normal Balmer decrement for an electron temperature of 20 000°K. reduced by an overlying stratum of Ca atoms. A. HU.

523.841.372.4.035.92 : 523.821.5 2708

Six-colour photometry of stars. II. Light-curves of δ Cephei. STEBBINS, J. *Astrophys. J.*, 101, *pp.* 47–55, *Jan.*, 1945.—Photoelectric light-curves of δ Cephei are given for 6 wavelengths ranging from the ultra-violet (3 530 Å) to the infra-red (10 300 Å). The amplitude of variation ranges from 1·48 mag. to 0·43 mag. respectively. The curves show no secondary fluctuations and repeat from year to year. They show a progressive forward movement in phase amounting to 0·05 period (0·27 day) between ultra-violet and infra-red. In colour and spectrum δ Cephei at max. resembles a *c*F4 supergiant; at min. it resembles *c*G2. The retardation of phase with increasing wavelength, it is suggested, indicates pulsations in the atmosphere as well as in the body of the star. A. HU.

523.841.374 : 523.84.035.94 *see Abstr.* 2706

523.841.9 2709

Eclipses of stars with thick atmospheres. GAPOSCHKIN, C. P., AND GAPOSCHKIN, S. *Astrophys. J.*, 101, *pp.* 56–70, *Jan.*, 1945.—The theory of thick atmospheres is used to investigate the distribution of intensity over a stellar disc as a function of temperature, wavelength and atmospheric structure. Intensity distributions are tabulated for physically

interesting ranges of these variables, and used for graphically computing the forms of several typical eclipses, central and partial, with the components of differing radii and luminosities. The theoretical curves are applied to the light curves observed for several stars for which the standard solutions reveal anomalies, and appreciable modifications are shown to be necessary in present ideas. The effect of the theory on interferometrically-measured radii is indicated. A. HU.

523.841.9 2710

The eclipsing variable TX Ursae Majoris. HILTNER, W. A. *Astrophys. J.*, 101, *pp.* 108–113, *Jan.*, 1945.—Elements are given for this star from a new spectroscopic orbit derived from 120 McDonald spectrograms. The eccentricity of 0·029 is consistent with the photometric observations but diverges entirely and inexplicably from a previous spectroscopic eccentricity of 0·162. The secondary star is newly classified as *g*F2. A sharp K time observed during primary min. is explained as light from the B8 component shining through the outer atmosphere of the F2 component. A. HU.

523.841.9 2711

The spectroscopic orbit of SVS 923 Herculis. CESCO, C. U., AND SAHADE, J. *Astrophys. J.*, 101, *pp.* 114–116, *Jan.*, 1945.—Spectrographic elements are derived for this star from 48 McDonald spectrograms. It is a single-spectrum binary (B5–B8), the star of observed spectrum being eclipsed at primary min. A. HU.

523.841.9 2712

The spectrum of W Serpentis. BAUER, C. A. *Astrophys. J.*, 101, *pp.* 208–223, *March*, 1945.—Radial-velocity and spectral variations are determined from 31 McDonald spectrograms covering 5 consecutive cycles in 1943, simultaneous visual observations being made to give a light curve accurately phased with respect to the velocity curve. The orbital elements derived from the 2 curves considered separately are incompatible, and it is suggested that the velocities observed are not those of the c.g. of a component but of complicated motions in an extended shell surrounding the system. All lines vary with phase, the H emission lines having strong red components at min. and strong violet components near phase $0^{P}\cdot35$. At max. light the absorption spectrum resembles that of a G supergiant with that of a later-type dwarf superposed, but it seems certain that only one source is present, many of the absorption features being produced in the postulated shell. At min. light emission lines of ionized metals appear. The system is compared and contrasted with SX Cass and RX Cass. A. HU.

523.841.9 2713

Spectrographic observations of the eclipsing variable AB Persei. STRUVE, O. *Astrophys. J.*, 101, *pp.* 232–234, *March*, 1945.—The velocity curve derived from 25 spectrograms is distorted by unknown causes and cannot be reconciled with the light curve, which is that of a normal eclipsing variable. Changes in character of the absorption lines are described. The small range of the velocity curve suggests either a small mass or a mass-ratio very different from 1. A. HU.

523.841.9 2714

The spectroscopic orbit of AU Monocerotis. SAHADE, J., AND CESCO, C. U. *Astrophys. J.*, 101, *pp.* 235–239, *March*, 1945.—This binary consists of a B5 star partially eclipsed at primary min. and an F0 star whose spectrum is visible only during eclipse. Orbital elements are derived from the He lines since variations in the H lines are noticed during the cycle. Discrepant radial velocities shown by the latter are attributed to a flow of cool gas between the F star and the B5 component. A. HU.

523.841.9 2715

The spectrum of RZ Scuti. NEUBAUER, F. J., AND STRUVE, O. *Astrophys. J.*, 101, *pp.* 240–248, *March*, 1945.—The velocity curve of this eclipsing variable, derived from 128 Lick and McDonald spectrograms, shows a large rotational disturbance in the partial phases. The He lines have a range of 250 km./sec.; the H lines of only 100 km./sec. It is suggested that hydrogen forms a slowly-rotating shell around the rapidly-rotating layer which gives rise to the lines of He I and Mg II. A. HU.

523.852.32 : 523.802 2716

Star counts in the Andromeda nebula. SEYFERT, C. K., AND NASSAU, J. J. *Astrophys. J.*, 101, *pp.* 179–186, *March*, 1945.—Counts of stars of mag. 15·0 to 18·5 in and around M 31 are made on blue-sensitive plates secured with a 24/36 in. Schmidt camera. The magnitudes are established via a special standard sequence calibrated against the north polar sequence. The apparent shape of the nebula is elliptical and agrees with the isophotal contours. Between the limits of abs. mag. $-3\cdot8$ and $-6\cdot3$ there are found to be 2 564 stars belonging to the nebula. The observed luminosity distribution in the main body of M 31 (diameter 6 000 parsecs) is compared with that in other spirals, the Magellanic Clouds and the Milky Way. The resemblance is close with the bright stars in the solar neighbourhood, but the border region (6 000–11 000 parsecs) is deficient in stars brighter than $-5\cdot3$, and may consist of a stellar population similar to that found by Baade [Abstr. 821 (1945)] in the nucleus. A. HU.

523.87 : 535.335 2717

Recent progress in the interpretation of stellar spectra. STRUVE, O. *Rev. Mod. Phys.*, 16, *pp.* 286–300, *July–Oct.*, 1944.—Discusses a number of problems in connection with the mechanisms which produce excitation and ionization, particularly for peculiar stellar spectra. Forbidden transitions of Fe II and the unusual strength of He I singlet (as compared with triplet) lines, are discussed at length. A. H

523.87 : 537.56 2718

The negative ions of hydrogen and oxygen in stellar atmospheres. CHANDRASEKHAR, S. *Rev. Mod. Phys.* 16, *pp.* 301–306, *July–Oct.*, 1944.—In view of the importance of the negative ions of H in theoretical astrophysics a review is made of the physical studies which have been made relating to this ion. A similar review is made for the negative ion of O. A. H

523.872 2719

Note on departures from black-body conditions in stars. SEARES, F. H., AND JOYNER, M. C. *Astrophys. J.*, 101, *pp.* 36–38, *Jan.*, 1945.—Comparison of the revised international colour indices with photoelectric

colours [see Abstr. 2721 (1945)] gives a linear relation. The corresponding theoretical relation for black-body radiators is non-linear. Departures from black-body conditions in the stars, mainly due to line and continuous H absorption, explain the difference satisfactorily. The observed relation is unlikely to remain linear for B stars. Allowance for the differential effect accounts for the discrepancy of 400°K. between the corresponding colour temperatures of K0 stars found in a previous paper [Abstr. 343 (1944)]. A. HU.

523.872 2720

Spectrographic observations of peculiar stars. VII. SWINGS, P., AND STRUVE, O. *Astrophys. J.*, 101, *pp.* 224–231, *March*, 1945.—Wavelengths and identifications of ultra-violet emission lines are tabulated for VV Ceph in the region 3 100–3 370 Å and for BF Cygn in the region 3 114–3 889 Å. The Be star MWC 56 has strong emission lines of H and Fe II. The increase of excitation in Z Andr previously reported [Abstr. 1257 (1944)] continues; radial velocities between Sept. 1939 and Oct. 1944 are listed for 12 groups of lines. Separate spectrograms of the components of MWC 451 (separation 0″·8) show a G5 spectrum for the visually brighter star and a typical shell spectrum for the blue star. A. HU.

523.872 : 523.67 : 535.338.4 *see Abstr.* 2904

523.872 : 523.899 2721

Revised standards of colour index for polar stars. SEARES, F. H., AND JOYNER, M. C. *Astrophys. J.*, 101, *pp.* 15–35, *Jan.*, 1945.—The international standards of colour index to magnitude 15 are revised by combining the original standards with exposure-ratio observations, effective wavelengths and recent precision magnitudes. The final scale, based on 141 stars, is practically identical with the original, but accidental (mean) errors are reduced from ±0·05 mag. to less than ±0·02 mag. The revised colours are compared with photoelectric values and general confirmation of the system of weighting is found. A. HU.

523.872 : 530.145.6 : 535.343.1 *see Abstr.* 2927

523.873 2722

A proposal for the classification of white-dwarf spectra. LUYTEN, W. J. *Astrophys. J.*, 101, *p.* 131, *Jan.*, 1945.—The characteristic of white dwarfs is not that they are whiter than main-sequence stars but that they are more extreme dwarfs. A classification is therefore suggested in which the Draper letters are preceded by D: thus the type-star is DA and those of lower temperature are DF, DG, . . . Stars whose spectra show no lines are classed as DC followed by a two-digit number indicating the estimated surface temperature in thousands of degrees. A. HU.

523.877 2723

On the radiative equilibrium of a stellar atmosphere. V. CHANDRASEKHAR, S. *Astrophys. J.*, 101, *pp.* 95–107, *Jan.*, 1945.—Previous work [Abstr. 829, 830 (1945)] is extended to treat radiative transfer in atmospheres of finite radius of curvature, i.e. the extended atmosphere of observational astrophysics. The basic equation of transfer is set up and replaced by an equivalent system of $2n$ linear equations in the nth approximation. Solutions of the equations of the 2nd approximation involve (in the astrophysically important case) quadratures over Bessel functions of purely imaginary arguments, and are obtained numerically. The case of diffusion through a homogeneous sphere is considered. A. HU.

523.899 : 523.821.3 *see Abstr.* 2704

523.899 : 523.823.5 *see Abstr.* 2705

523.899 : 523.872 *see Abstr.* 2721

525.233 : 550.371 2724

Electric potential of the earth's surface. ARLICK, A. B. *Curr. Sci.*, 14, *p.* 151, *June*, 1945.

525.75 : 551.594.12 2725

Night-sky emission and region F ionization. MITRA, S. K. *Nature, Lond.*, 155, *p.* 786, *June* 30, 1945.

526.943 2726

Altitude by measurement of air pressure and temperature. BROMBACHER, W. G. *J. Wash. Acad. Sci.*, 34, *pp.* 277–299, *Sept.*, 1944.—The form and accuracy of the fundamental altitude formula are discussed, and the application of temperature, humidity and gravity corrections described. The altitude-pressure relations constituting the various standard atmospheres are compared, and the standard adopted by the International Committee for Aerial Navigation, and its modifications, are defined. Examples are given of the use of the formulae in surveying, mountaineering, exploration and aeronautics. Brief descriptions of the currently available aneroid barometers and altimeters are given, and their performances are compared and likely sources of error pointed out. A. HU.

526.967 : 625.11 2727

Pantograph for railway structure profiles. *Engineering*, 160, *p.* 105, *Aug.* 10, 1945.—[Abstr. 2727 B (1945)].

53 2728

Physical properties of butanes and butenes. WACKHER, R. C., LINN, C. B., AND GROSSE, A. V. *Industr. Engng Chem.*, 37, *pp.* 464–468, *May*, 1945.—Data on physical properties of *n*-butane, isobutane, 1-butene, *cis*-2-butene, *trans*-2-butene, and isobutylene are surveyed. Data were redetermined where discrepancies occur and, when absent, measured. Properties include refractive indices, liquid densities, b.p., v.p., and m.p. Refractive indices, from −10 to −50°C., of C_4 hydrocarbons and the liquid densities, from 0 to −70°C., of *cis*- and *trans*-2-butene are given. New data on liquid densities <0°C. are presented for isobutane, isobutylene, and 1-butene. The vapour pressures from 20–800 mm. were measured on *n*- and isobutane.

53 2729

Physical properties of acrylonitrile. DAVIS, H. S., AND WIEDEMAN, O. F. *Industr. Engng Chem.*, 37, *pp.* 482–485, *May*, 1945.

53 : 378 : 727 : 621.317.2 2730

Design of instructional laboratories. *Amer. J. Phys.*, 13, *pp.* 182–202, *June*, 1945.—A symposium of papers with the following titles: The functions of the housing committee, Davey, W. P.; Floor plans, Overbeck, C. J.; The physics lecture room and its equipment, Buchta, J. W.; Laboratory electric services for the undergraduate physics laboratory, Howe, C. E.

53 : 621.18 2731

Some applications of physics in power-plant engineering. MASKELL, W. G. *J. Sci. Instrum.*, 22, *pp.* 181–184, *Oct.*, 1945.

53.085.4 2732

An adjustable scale for measuring instruments. KOCH, W. *J. Sci. Instrum.*, 22, *pp.* 94–95, *May*, 1945.—A method is described for constructing and using a scale which compensates for calibration errors. The principle involves the use of 3 fixed points; the appropriate scale reading is determined by the intersection of a movable line with an arc passing through each point of the scale. The line is adjusted by reference to the fixed points.

530.1 : 7.01 2733

The physicist's mind and the judgment of art. JOHNSON, M. *J. Sci. Instrum.*, 22, *pp.* 121–125, *July*, 1945.—The author contends that the criterion of truth and significance in both science and art is to be found in communicability of mental patterns. Neither artistic nor scientific conceptions derive their validity from being "true to life." G. C. McV.

530.12 2734

Kinematic relativity. NEWING, R. A. *Phil. Mag.*, 36, *pp.* 113–115, *Feb.*, 1945.—A difficulty recently encountered by W. Wilson [Abstr. 1954 (1944)] in a consideration of Milne's theory is explained. [See Abstr. 2735 (1945)]. L. S. G.

530.12 2735

Kinematic relativity: a reply to W. Wilson. MILNE, E. A. *Phil. Mag.*, 36, *pp.* 134–143, *Feb.*, 1945.—A reply to criticism [Abstr. 1954 (1944)] of the author's work in relativity. Milne shows that Wilson's contentions are wrong since they rest on a faulty use of the 4-vector calculus. L. S. G.

530.12 2736

On the vectors and invariants of kinematic relativity. WHITROW, G. J. *Phil. Mag.*, 36, *pp.* 170–178, *March*, 1945.—Wilson's recent criticism [Abstr. 1954 (1944)] of Milne's formula for the equation of motion of a free particle moving in the uniformly expanding substratum is refuted; 4-vectors are discussed and the 6-vectors and invariants of kinematic relativity are considered, including their physical interpretation. L. S. G.

530.12 : 531.18 2737

On accelerated coordinate systems in classical and relativistic mechanics. HILL, E. L. *Phys. Rev.*, 67, *pp.* 358–363, *June* 1 *and* 15, 1945.—A simplified discussion is given of the problem of introducing linearly accelerated axes by a method applicable alike to classical and relativistic mechanics. The mathematical method is based on the Lie theory of the 4-dimensional conformal group which is presented in such a way that the transformations leading to accelerated axes are exhibited explicitly. The classical theory is shown to be a degenerate case of the relativistic theory, so that the transformations to accelerated axes have a geometrical interpretation in terms of inversive transformations in both theories.

530.12 : 531.51 2738

The two-body gravitational problem in kinematical relativity. CAMM, G. L., MILNE, E. A. *Nature, Lond.*, 155, *pp.* 754–755, *June* 23, 1945.—In Milne's theory of the two-body gravitational problem [Abstr. 2384 (1937)] let (t_1, P_1) and (t_2, P_2) be the epochs and vector positions of the 2 particles. A relation between these variables is necessary in order to integrate the equations of motion, and Milne used the relation $t_1 = t_2$. Schild [Abstr. 1233 (1945)] showed that the resulting theory is not Lorentz invariant and suggested that the theory is invalid. Plausible reasons are now given for adopting the convention $t_1^2 - P_1^2/c^2 = t_2^2 - P_2^2/c^2$, in place of $t_1 = t_2$, and this gives a definition of simultaneity which is Lorentz invariant. It is shown that the convention adopted arbitrarily by Schild is invalid because it is not symmetrical. L. S. G.

530.12 : 531.51 2739

The two-body problem in Milne's theory of gravitation. WHITROW, G. J. *Nature, Lond.*, 156, *pp.* 365–366, *Sept.* 22, 1945.—A conclusive reason is given for imposing, in a unique manner, the condition $t_1^2 - P_1^2/c^2 = t_2^2 - P_2^2/c^2$ [Abstr. 2738 (1945)] which was only made plausible by Camm. L. S. G.

530.12 : 537.591 *see Abstr.* 3051

530.145 2740

The quantum mechanics of a bounded linear harmonic oscillator. AULUCK, F. C., AND KOTHARI, D. S. *Proc. Camb. Phil. Soc.*, 41, *pp.* 175–179, *June*, 1945.—An extension is made of previous treatments [Abstr. 1849 (1943), 1730 (1941)]. The Schrödinger equation for a linear harmonic oscillator is solved in the case where the usual boundary condition, that the wave function vanishes at infinity, is replaced by the condition that it vanishes at the walls of the oscillator. Curves of W_n, the energy of the nth state, are given for the ground state ($n = 1$) and for the next two higher states ($n = 2, 3$). L. S. G.

530.145 2741

The reality problem in quantum mechanics. EPSTEIN, P. S. *Amer. J. Phys.*, 13, *pp.* 127–136, *June*, 1945.—The dualist and phenomenological views of the problem of reality are discussed. The problem is considered from the psychological, philosophic, and physical aspects. Some examples of unobservables which have no reality on the basis of the quantum theory are discussed. A. J. M.

530.145 2742

Operators in quantum theory. COOPER, J. L. B. *Nature, Lond.*, 156, *p.* 54, *July* 14, 1945.—A discussion of hypermaximal and Hermitian operators, and an examination of the physical meaning of the requirement that quantum mechanical operators be hypermaximal. It is shown that only those Hermitian operators, H, are hypermaximal, for which the corresponding Schrödinger equation $H\psi(t) = i^{-1}d\psi/dt$, with the initial condition $\psi(0) = \phi$, has a solution for all positive and negative t and for every wave function ϕ lying in the domain of the operator H. L. S. G.

530.145 : 517.948.33 *see Abstr.* 2683

530.145 : 536.71 : 539.2 : 548.7 2743

Variation of interaction energy with change of lattice constants and change of degree of order. YANG, C. N. *Chinese J. Phys.*, 5, *pp.* 138–149, *Dec.*, 1944.—The change of lattice constants due to an order-disorder process in a superlattice is investigated by using the condition of minimum free energy in Bethe's theory.

ıe interaction energy depends on the degree of order ıen the external pressure is kept constant. The ecific heat at constant pressure is calculated and mpared with the values found by experiment. ıother factor influencing the variation of interaction ergy is the change of atomic arrangements. This is vestigated from the viewpoint of Wang's formulation the free energy in Bethe's approximation. L. S. G.

0.145 : 536.73 = 4 *see Abstr.* 3005

0.145.6 2744

On the wave equations for particles with variable spin. NSBURG, V., AND SMORODINSKY, J. *J. Phys., SSR*, 8, 1, *pp.* 52–53, 1944.—By an (*i*, *j*) particle meant one which can exist in states with spins and *j* and with different values of the rest mass. ıe relativistic wave equations for such a particle, ently proposed by Ginsburg, are said to split up by means of a certain transformation of the wave nctions, they reduce to a system of equations for particle with the spin *i* and for a particle with the in *j*, which are independent of each other. It is own that the equations for a (0, 1) particle and r a $(\frac{1}{2}, \frac{1}{2})$ particle always split up in the absence of field and also in the case of a certain type of interion with an electromagnetic field. The equations r a (1, 2) particle are also separable in the absence a field, but this is not the case for a $(\frac{1}{2}, \frac{3}{2})$ particle. L. S. G.

0.145.6 2745

On the theory of bi-particles. I. IWANENKO, D., D SOKOLOW, A. *J. Phys., USSR*, 8, 1, *pp.* 54–55, 44.—A criticism of recent articles by Ginsburg. is shown that the equations describing the bi-particles spin $(\frac{1}{2}, \frac{1}{2})$ and (0, 1) may be split into 2 indeendent systems. L. S. G.

0.145.6 2746

The energy levels of "holes" in liquids. AULUCK, C., AND KOTHARI, D. S. *Proc. Camb. Phil. Soc.*, *pp.* 180–183, *June*, 1945.—The classical treatment Fürth [Abstr. 2369 (1941)] is replaced by a wavechanical treatment of the energy levels. The relent Schrödinger equation is solved by the B.W.K. ethod and the eigenvalues for the energies of the oles are determined. The quantization of the radial otion gives rise to discrete energy levels. L. S. G.

0.145.6 2747

Algebra related to particles of spin $\frac{3}{2}$. RAO, B. S. M., ENKATACHALIENGAR, K., AND THIRUVENKATACHAR, . R. *Curr. Sci.*, 14, *p.* 180, *July*, 1945.—[See Abstr. 4 (1943)].

0.145.6 : 523.872 : 535.343.1 *see Abstr.* 2927

0.145.6 : 535–1 : 548.0 *see Abstr.* 3120

0.145.6/.7 : 539.13 2748

Degenerate modes of vibration and perturbations in olyatomic molecules. SHAFFER, W. H. *Rev. Mod. ys.*, 16, *pp.* 245–259, *July–Oct.*, 1944.—A quantumechanical investigation of the allowed energies, fects of perturbations, and selection rules based on e solutions of the wave equations, or their equivalents, r the 2- and 3-fold isotropic oscillators. The lutions are in terms of polar co-ordinates in order at account may be taken of the angular momentum sociated with isotropic oscillations. A. H.

530.145.63 : 539.152.1 2749

Dirac's equation for the neutron and proton. CHIRGWIN, B. H., AND FLINT, H. T. *Nature, Lond.*, 155, *p.* 724, *June* 16, 1945.—The equation proposed is $\gamma^\mu \frac{\partial \psi}{\partial x^\mu} = g\gamma^\nu\gamma^\mu(T_{\mu\nu}\tau + T^*_{\mu\nu}\tau^*)\psi$ where the γ^μ are matrices related to the Dirac matrices, ψ is the function found in Dirac's equations, $T_{\mu\nu}$ is the tensor of the nuclear field, τ is the matrix $\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$ and the asterisk denotes the conjugate complex. The equation is five-dimensional following the idea of Kaluza but contains only one constant g. The equation has also been given by H. J. Bhabha though he established it by a different method. G. C. McV.

531.15 2750

Rotations of a rigid body about a fixed point. HILL, E. L. *Amer. J. Phys.*, 13, *pp.* 137–140, *June*, 1945.—The spinor method is used for deriving the basic formulae relating to finite rotations. Application is made to Cartesian transformations, Eulerian rotations and, as a limiting case, infinitesimal rotations. L. S. G.

531.15 : 531.381 2751

Erratum: On the representation of rigid rotations. BENEDIKT, E. T. *J. Appl. Phys.*, 16, *p.* 551, *Sept.*, 1945.—[See Abstr. 98 (1945)].

531.18 : 530.12 *see Abstr.* 2737

531.224 2752

Theory of bending, torsion and buckling of thin-walled members of open cross section. TIMOSHENKO, S. P. *J. Franklin Inst.*, 239, *pp.* 201–219, *March*; 249–268, *April, and pp.* 343–361, *May*, 1945.—In Part I the bending of thin-walled members of open cross section is analysed, and a quantity, the "shear flow," is determined. From this is established the notion of the "shear centre" of a cross section, which is such that any transverse forces distributed along the shear centre axis will produce only bending without torsion. Pure torsion is then analysed. In Part II non-uniform torsion of thin-walled bars is discussed and the identity of shear centre and centre of twist is established. Torsional buckling under central thrust follows. In Part III the analysis of buckling by flexure and torsion is given, and problems of instability of beams are studied. G. E. A.

531.259.1 : 624.04 2753

Inelastic buckling of variable-section columns. YOUNG, D. *J. Appl. Mech.*, 12, *A165–A169*, *Sept.*, 1945.—[Abstr. 2724 B (1945)].

531.3 2754

A demonstration laboratory for advanced dynamics. WELLS, D. A. *Amer. J. Phys.*, 13, *pp.* 147–155, *June*, 1945.—An extensive laboratory of dynamical models has been built up in order to make clear the basic laws on which dynamics is founded and, in particular, to give physical meaning to the quantities and terminology employed in Lagrangian dynamics and to the Lagrangian equations of motion. The laboratory contains about 45 models on the walls and on narrow tables round a 20 × 25 ft. lecture room. The items consist of rods, pendulums, springs, systems with, in one case, 10 degrees of freedom, and other models, and the equipment of a number of the models is described in detail. G. E. A.

531.3 : 539.31 : 625.2 2755

Dynamics of an elastic bar. WIKANDER, O. R. *J. Appl. Mech.*, 12, *A101–A106*, *June*, 1945.—A solid elastic bar with a force pulling at one end is taken as a basis for the study of train dynamics, and propositions on the elastic bar are analysed under conditions corresponding to the starting, braking and change in grade of the track of a long train with or without free slack. For convenience the derived equations are rewritten in terms of train data. G. E. A.

531.381 : 531.15 *see Abstr.* 2751

531.383 2756

"Action equals reaction"—even in gyroscopes. ROOD, P. *Amer. J. Phys.*, 13, *pp.* 175–177, *June*, 1945.

531.383 : 621.3.012.8 : 629.135 : 534.372 *see Abstr.* 2844

531.383 : 621.317.39 : 531.76 : 531.775 *see Abstr.* 2767

531.39 : 621.83 2757

Distribution of tooth load along a pinion. PORITSKY, H., SUTTON, A. D., AND PERNICK, A. *J. Appl. Mech.*, 12, *A78–A86*, *June*, 1945.—The authors consider only the bending and twisting of the pinion shaft and the deflections of the gear and pinion teeth relative to their bases under the load and torque transmitted. The change of load is considered as a consequence of the deflections, and a fourth-order differential equation is obtained for the load distribution. Boundary conditions are formulated and examples of solutions given. It is assumed that perfect geometrical cutting, assembly, mounting and fit of the gears have been secured. G. E. A.

531.39 : 621.83 2758

Load distribution of reduction gears. LEWIS, F. M. *J. Appl. Mech.*, 12, *A87–A90*, *June*, 1945.—This simple method of determining load distribution [see Abstr. 2757 (1945)] assumes uniform load distribution to find the distortion curve of the pinion due to bending and torsion. The pinion is held rigidly to this shape and the teeth are elastic. The distorted pinion is rotated, the teeth deflecting, until the correct load is carried. The load distribution curve for this condition is known. With the new curve another curve of pinion distortion from bending and torsion is found. The process is repeated, two steps being sufficient. The paper enters into particulars of the process, and the examples of the paper quoted above are used to facilitate comparison of the two methods. G. E. A.

531.51 : 530.12 *see Abstr.* 2738, 2739

531.51 : 538.111 *see Abstr.* 3056

531.55 : 533.6.015 *see Abstr.* 2830

531.66 2759

Ball pendulum impact experiments. SATTERLY, J. *Amer. J. Phys.*, 13, *pp.* 170–174, *June*, 1945.

531.714 : 621.396.615.14 2760

The use of radio-frequency apparatus in inspection. CORNELIUS, J. *Machinery, Lond.*, *pp.* 473–476, *May* 3, 1945.—An instrument is described by means of which such minute variations as 10^{-9} in. can be detected. The apparatus uses r.f. and f.m. and its cost is a fraction of that of an instrument of the mechanical type detecting to 10^{-5} in. The instrument employs no mechanical magnification. M.-V.

531.717.1 : 578 276

Apparatus for measuring mean cell-diameters in blood film. HOGBEN, M. *Nature, Lond.*, 155, *pp.* 576–577, *May* 12, 1945.

531.724 276

On the possibility of estimating the average surface area of solid particles. CASSEL, H. M. *J. Chem. Phys.*, 13, *p.* 249, *June*, 1945.

531.731.2 276

The partial specific volume of zein and gliadin. FOSTER, J. F., AND FRENCH, D. *J. Amer. Chem. Soc.*, 67, *pp.* 687–688, *April*, 1945.—The partial specific volumes of zein and gliadin in 73 wt.-% and 62 wt.-% aq. alcohol were measured in a dilatometer fitted with a stopper to minimize solvent evaporation. W. R. A.

531.731.3 276

Determination of the capacity of shallow jars. CALEY, E. R. *Industr. Engng Chem. (Analyt. Edit.)*, 17, *pp.* 442–444, *July*, 1945.

531.732 : 541.123 = 3 276

Partial specific volumes in binary and tertiary solutions. DRUCKER, C. *Ark. Kemi Min. Geol.* 14*A*, *No.* 15, 48 *pp.*, 1941.

531.758 276

Centrifugal gas specific gravity meter. DOWLING, J. J. *J. Sci. Instrum.*, 22, *pp.* 145–146, *Aug.*, 1945.—If a tube filled with gas is revolved about one end a pressure difference, approx. $= \frac{1}{2}\omega^2 l^2 \rho$, is developed between the ends of the tube, where l = length of tube, ω = angular velocity, and ρ = mean density of gas. With reasonable values of l and ω, the pressure difference can be accurately measured on a sloping tube gauge filled with an oil of low density, v.p. and viscosity.

531.76 : 531.383 : 621.317.39 : 531.775 *see Abstr.* 276

531.775 : 531.76 : 531.383 : 621.317.39 276

A tachometer-accelerometer-vibrometer for instrument gyroscope testing. LAURENSON, R. M., AND LONG, T. H. *Trans. Amer. Inst. Elect. Engrs*, 64, *pp.* 593–596, *Aug.*, 1945.—The instrument, which is of the electronic type, embodies the functions of a tachometer, accelerometer and vibrometer as a single unit. The description of its development and final design contains a detailed account of the tachometer accelerometer valve circuit which forms its distinctive feature, and includes several illustrations as well as coast curves of gyroscope rotors obtained with it. The method of using it for indicating the gyroscope rotor speed at 1 000 r.p.m. for the bearing adjustment, the rate of deceleration during the adjustment, and vibration tests up to 15 000 r.p.m. is fully explained. H. G. S.

531.775 : 621.317.39 276

Electronic tachometer. *Electronic Industr.*, 4, *pp.* 80–81 *et seq.*, *March*, 1945.—The equipment described provides continuous record of instantaneous speeds over the range $600–3 \times 10^6$ r.p.m. and eliminates fractional or multiple errors. A steady beam of light, interrupted by the movements of a reflecting surface on the rotating mechanism, produces a pulsating current in a photo-electric circuit connected via an amplifier to a visual frequency meter. The instrument can also be used for the measurement

f frequencies of alternating voltages, in the range)–50 kc/s." [See also Abstr. 1698 (1945)]. E. R. A.

31.787 2769

The design and production of pressure gauges. 'OLLACOTT, R. A. *Trans. Inst. Mar. Engrs*, 57, p. 59–66, *May*, 1945.—A descriptive survey. For ow pressure measurements diaphragm types, as the neroid barometer, are common, and for high ressures the Bourdon tube type is better. Typical onstructions are described, with mechanisms, nountings, connections, scales and pointers, etc., ollowed by notes on testing and accuracy. Examples f commercial gauges are shown. E. H. W. B.

31.787.1 2770

Glass spirals for use in sensitive pressure gauges. 'ORKE, S. G. *J. Sci. Instrum.*, 22, *p.* 196, *Oct.*, 945.

32 : 536.7 : 576 2771

The energetics of transient and steady states, with special reference to biological systems. REINER, J. M., ND SPIEGELMAN, S. *J. Phys. Chem.*, 49, *pp.* 81–92, *March*, 1945.—A mathematical study of the energetics nd the mass transport of non-stationary systems of ne kind encountered in biological phenomena, ncluding the stationary but non-equilibrium state as special case. Results of biological interest are iscussed. N. M. B.

32.13 2772

Viscosity patterns of peanut protein solutions. Comparison with other vegetable proteins and with asein. BURNETT, R. S., ROBERTS, E. J., AND PARKER, . D. *Industr. Engng Chem.*, 37, *pp.* 276–281, *March*, 945.

32.13 : 532.517 *see Abstr.* 2784

32.13 : 536.7 : 537.312.62 *see Abstr.* 3016

32.13 : 537.363 : 577.1 2773

Denatured egg albumin. I. The preparation and urification of crystalline egg albumin denatured in arious ways. II. Viscosities. III. Quantitative mmunochemical studies on crystalline egg albumin enatured in various ways. MACPHERSON, C. F. C., ND HEIDELBERGER, M. *J. Amer. Chem. Soc.*, 67, p. 574–591, *April*, 1945.—The controlled preparation f various types of relatively undegraded DnEa is escribed and conditions are given under which ensitive types of DnEa may be purified by isoelectric precipitation and re-solution without increase in pparent aggregation. The fluidities of several lots f acid-, alkali- and heat-DnEa were determined uring ageing periods of several months and axial atios calculated. The quantitative immunochemical echnique supplemented information gained by arallel chemical and physical studies of DnEa. Definite structural entities are indicated.

532.133 2774

Viscosity of ordinary liquids at high rates of shear. GRUNBERG, L., AND NISSAN, A. H. *Nature, Lond.*, 156, *p.* 241, *Aug.* 25, 1945.

532.133 2775

Degree of association of water from the energy of viscosity and the work of cohesion. GRUNBERG, L., AND NISSAN, A. H. *Nature, Lond.*, 156, *pp.* 335–336, *Sept.* 15, 1945.—[See Abstr. 117 (1945)].

532.133 : 621.43.019.7 2776

The problem of engine deposits. LAHIRI, A., KARPINSKI, Z., AND MARDLES, E. W. J. *J. Inst. Petrol.*, 31, *pp.* 271–302, *Aug.*, 1945.—Measurements were made of the specific viscosity of (*a*) dispersions of aero-engine deposits and oxidized oil products to determine mol. wts. and asymmetry of the constituent particles and (*b*) of C dispersions in oils and non-aqueous media to measure the degree of flocculation. The flow behaviour of mineral oils oxidizing at high temp. was studied, using a coni-cylindrical rotor fitted with small vanes immersed in the oil and operated by wts. acting over a pulley. It was found that rigidity developed slowly at first with time, then the oxidizing oil suddenly gelated when the conc. and degree of polymerization of the oxidized products reached a critical value. This behaviour was confirmed by measurements made with a tackmeter. The tendency of an oil to deposit soot and other combustion detritus in suspension was measured from (*a*) torsional rigidity and yield values and (*b*) sedimentation rates and volumes. A high degree of flocculation of carbon black results in high specific viscosity, high sedimentation rates and volumes, and high rigidities and yield values of the suspensions.

532.133 : 541.68 2777

Solute type and viscosity of dilute solutions of high polymers. SPEISER, R., AND WHITTENBERGER, R. T. *J. Chem. Phys.*, 13, *pp.* 349–350, *Aug.*, 1945.

532.137 2778

Microviscometer. WEYER, E. R. *Science*, 101, *pp.* 521–522, *May* 18, 1945.—Measurements are made in terms of resistance to the torque developed by a small synchronous, self-starting electric clock motor.

532.137 2779

A flow-curve recorder for a rotational viscometer. WELTMANN, R. N. *Rev. Sci. Instrum.*, 16, *pp.* 184–191, *July*, 1945.—A recorder which draws complete flow curves was developed as an attachment for a Couette type of viscometer. The deflection of the bob, $\propto$ the shearing stress, is plotted against the speed of the cup which $\propto$ the rate of shear. The recorder uses sparks generated by a high voltage to puncture the recording paper. The sparking electrode is moved by the bob deflection spring while the paper is moved perpendicularly to the electrode motion by the transmission handle, the position of which controls the cup speed. A number of measurements made with the recorder are shown. The recorded flow curves permit immediate interpretation and calculation of the plastic viscosity, the yield value, and the thixotropic behaviour of the tested materials. A method is proposed for determining the plastic viscosity and the yield value at initial agitation.

532.137 : 521.389 2780

Note on an improved falling sphere viscometer for use with opaque liquids. MCDOWELL, C. A., AND WALKER, B. Y. *Chem. and Ind.*, *p.* 323, *Oct.* 20, 1945.

532.137 : 621.892 2781

The precision and accuracy of viscometry using B.S.I. tubes. *J. Inst. Petrol.*, 31, *pp.* 239–247, *Aug.*, 1945.

532.14 : 536.42 2782

The silicon chlorobromides. ANDERSON, H. A. *J. Amer. Chem. Soc.*, 67, *p.* 859, *May*, 1945.—Values

for some of the physical constants of the silicon chlorobromides have been determined, viz. $SiCl_3Br$, m.p. $-62°$, d_4^{25} 1·826; $SiCl_2Br_2$, m.p. $-45·5°$, d_4^{25} 2·172 m.; $SiClBr_3$, m.p. $-20·8°$, d_4^{25} 2·497. The b.p. of the chlorobromides have also been checked. W. R. A.

532.51 : 532.694.1 *see Abstr.* 2806

532.516 : 621.892 2783

Lubrication of metal surfaces by fatty acids. Bowden, F. P., Gregory, J. N., and Tabor, D. *Nature, Lond.*, 156, *pp.* 97–101, *July* 28, 1945.—The friction between two metallic surfaces depends on the nature of the underlying solid surfaces, the chemical series to which the lubricant belongs, and the number of carbon atoms in the chain. A monolayer of a fatty acid is sufficient to reduce the friction of glass surfaces from $\mu = 1$ for clean glass to approx. $\mu = 0·1$. With steel surfaces, a transition from intermittent motion to smooth sliding occurs at a chain length of 5 or 6 carbon atoms, i.e. at a mol. wt. of approx. 100. With steel surfaces, warming to 70°C. in the case of some lubricants, causes the motion to change from continuous sliding to stick-slips, while further temp. rise increases the size of the stick-slips, and the friction, causing a corresponding increase of wear. Experiments show that those metals which are most effectively lubricated are those which are most readily attacked chemically by the fatty acid. A. C. W.

532.517 : 532.13 2784

Flow orientation in isotropic fluids. Bondi, A. *J. Appl. Phys.*, 16, *pp.* 539–544, *Sept.*, 1945.—A theory of flow orientation is developed which is based on a relation giving the change in entropy accompanying molecular orientation under the influence of a stress field, and on the applicability of the Eyring theory of viscous flow. It predicts the ratio of the viscosity at attainment of complete orientation to the viscosity of "normal," i.e. random, flow to be equal to the ratio of the average length vl to the actual length of the (fully stretched) molecule. The thermodynamics of a flow-oriented system are outlined, predicting the temperature changes accompanying adiabatic orientation and disorientation. It is also suggested that the relaxation times in viscous media are large enough to prevent observation of flow orientation in capillary viscometers in many cases.

532.517.2 : 535.55 *see Abstr.* 2952–2954

532.517.3 : 535.551 : 541.18 2785

A double-refraction method of detecting turbulence in liquids. Binnie, A. M. *Proc. Phys. Soc., Lond.*, 57, *pp.* 390–402, *Sept.*, 1945.—The double-refractive properties of a weak solution of benzopurpurin were used in a study of the onset of turbulence when the liquid flowed through a long horizontal glass pipe. A beam of polarized light was arranged to traverse a diameter of the pipe remote from the ends, the nicols being set to give extinction when the liquid was stationary. The emergent light fell on a photo-cell connected to an amplifier and c.r.t. With unidirectional flow, photographs of the trace on the screen showed a steady straight line when the velocity was small. Disturbances appeared at a Reynolds number R of about 1 970, and complete turbulence when R reached 2 900. With forced oscillating flow, the trace at low velocities was a sinusoidal curve, on which, a a critical Reynolds number, small superposed ripple were observed. Even when the motion was great increased the intricate traces recurred perfectly, bu this phase finally broke up into complete turbulenc as soon as the amplitude of the surface movement i the bottles at the ends of the pipe reached a certai limit.

532.517.4 278

Experimental investigation of turbulence diffusion– a factor in transportation of sediment in open-chann flow. Van Driest, E. R. *J. Appl. Mech.*, 12, *A*91 *A*100, *June*, 1945.—Turbulence diffusion in oper channel flow was investigated experimentally b photographing the spread of globules formed by th injection of an immiscible fluid into water. The mean square transverse deviations of the globules at variou distances downstream from the source were compute and the shape of the velocity-correlation curve wa determined. Comparison was made between tw types of curve which fitted the deviation data, on corresponding to a power-correlation law and th other to an exponential-correlation law.

532.52 278

Water-hammer analysis by the Laplace–Melli transformation. Rich, G. R. *Trans. Amer. Soc. Mech Engrs*, 67, *pp.* 361–376, *July*, 1945.—The Heavisid calculus is replaced by the Laplace–Mellin transforma tion. This substitution is better adapted to problem starting from a steady-state system in motion, an permits working directly with total pressures an velocities instead of surge pressures and velocities It eliminates ambiguity concerning reflection coeffi cients at junction points in branched-conduit problems When the effect of friction is not included, results ar given in the form of simple trigonometric series o rapid convergence. When the abscissae of the tw terminal sections of the conduit are inserted in thes formulae, the resulting expressions are, in many cases Fourier representations in the time variable of well known periodic step or saw-tooth functions. In such instances, almost no computation work is required it is unnecessary to sum the series, as the value of th summation may be taken at a single reading from a graph of the function, one plot of such a function serving for all particular cases within its domain In cases where the effect of friction is included, a tabl of Bessel functions, used in conjunction with th formulae developed, affords easy and rapid solution

532.525 : 535.317.8 *see Abstr.* 2881

532.525 : 621.3.064.45 = 4 278

Pneumatic breaking of the electric arc. Labouret J. *Rev. Gén. Élect.*, 54, *pp.* 220–224, *July*, 1945.— [Abstr. 2427 B (1945)].

532.542.1 278

Flow of water through very narrow channels an attempts to measure thermomechanical effects in water Reekie, J., and Aird, J. *Nature, Lond.*, 156, *pp.* 367– 368, *Sept.* 22, 1945.—Experiments are made on th flow in channels of the order of 10^{-5} cm. in width.

532.542.4 279

The turbulent flow through a circular pipe. Chang S. L. *Chinese J. Phys.*, 5, *pp.* 124–137, *Dec.*, 1944.— The flow is studied by means of the improved genera

theory of turbulence [Abstr. 1318 (1945)]. The mean velocity distribution and the mean squares of velocity fluctuation are calculated. Graphs are given of the velocity fluctuation distribution in a circular pipe. The agreement with experiment is good. L. S. G.

532.57 2791

Globe-valve flow coefficients for valve meters. KROLL, A. E., AND FAIRBANKS, H. V. *Industr. Engng Chem.*, 37, *pp.* 588–591, *June*, 1945.—The conversion of an ordinary commercial valve into a flowmeter is described. The valve flow coefficient, K_v, from which the rate of liquid flow through a valve may be calculated, is defined in the following modified form of the fundamental flow equation: $K_v = 1{\cdot}496w/\sqrt{\rho\Delta P_t}$. Valve flow coefficients for various valve settings on different sizes of brass-disc valves are given with details of the experimental method. These coefficients were determined with Reynolds numbers, referred to the pipe, of 30 000–150 000.

532.57.082 2792

The coefficient of Herschel type cast-iron Venturi meters. PARDOE, W. S. *Trans. Amer. Soc. Mech. Engrs*, 67, *pp.* 339–344, *July*, 1945.—Curves for the meters based on 86 tests, made during the years 1928–1943, are given. W. A. R.

532.582.81 2793

Definitive equations for the fluid resistance of spheres. DAVIES, C. N. *Proc. Phys. Soc., Lond.*, 57, *pp.* 259–270, *July*, 1945.—The Reynolds number, r, of a moving sphere is expressed as a function of the dimensionless quantity, ψr^2, where ψ is the drag coefficient. Two equations are obtained (for r), by the method of least squares. One of these is valid in the range $r < 4$ or $\psi r^2 < 140$, and this tends to Stokes' law as $r \to 0$. It is convenient for the calculation of the sedimentation of air-borne particles. The other equation holds when $3 < r < 10\,000$. An expression is obtained for the correction for slip in gases which should be applied to Stokes' law.

L. S. G.

532.59 : 551.465 2794

Internal waves in the sea. EKMAN, V. W., AND DEACON, G. E. R. *Nature, Lond.*, 155, *pp.* 669–670, *June* 2, 1945.

532.61 2795

The measurement of surface and interfacial tensions at fresh surfaces by the vibrating jet method. ADDISON, C. C. *Phil. Mag.*, 36, *pp.* 73–100, *Feb.*, 1945.—Available methods for measuring surface tension and previous work on vibrating jets are briefly reviewed. Apparatus for vibrating jet measurements is described and also such details as the measurement of wavelengths and the preparation of the orifice tube, the shape of which has a pronounced effect upon the stability of the jet. Rayleigh's formula connecting the wavelength, the flow rate and the surface tension is used in deriving the latter from experimental data. The procedure, which is outlined step by step, brings the vibrating jet method within the scope of routine laboratory work. The use of vertical jets is discussed and the method is applied to the study of dynamic tensions of solutions, and extended to liquid/liquid interfaces. L. S. G.

532.61 : 532.72 2796

The change of surface tension with time. I. Theories of diffusion to the surface. ROSS, S. *J. Amer. Chem. Soc.*, 67, *pp.* 990–994, *June*, 1945.—Two published treatments of the hypothesis that the change in surface tension with time is due to the time required for the solute molecules to diffuse to the surface are correlated, the thermodynamic equation of Bond and Puls being supplemented by an equation based on a kinetic treatment of Doss's suggestion of a close-packed monomolecular layer. The latter treatment enables the diffusion mechanism to be tested in individual cases, whereas the thermodynamic treatment does not. Experimental data indicate that polymolecular surface layers, about 5 molecules deep, are present in solutions of short-chain soluble substances. W. R. A.

532.61.08 2797

The surface tensions of calcium chloride solutions at 25°C measured by their maximum bubble pressures. CUPPLES, H. L. *J. Amer. Chem. Soc.*, 67, *pp.* 987–990, *June*, 1945.—Surface tension of aq. solutions of $CaCl_2$ were measured over the concentration range 0·203–7·301 moles of $CaCl_2$ per 1 000 g of H_2O by the method of maximum bubble pressure and the results compared with those of previous workers.

W. R. A.

532.612 2798

The properties of freshly formed surfaces. V. A velocity-time equation for adsorption to dynamic surfaces. ADDISON, C. C. *J. Chem. Soc.*, *pp.* 354–359, *June*, 1945.—The dynamic surface tensions of aqueous solutions of *n*-alcohols reported in Part IV [Abstr. 1719 (1945)] were used to determine the true velocities of migration to the surface over the full time required for equilibrium. The velocity (v) and surface age (t) are shown to be related by the equation $v = a^n te^{-akt}$; n and k are functions of chain length but are independent of conc. At infinite dilution a is independent of chain length, and is a direct function of conc. Hence the surface behaviour of alcohols having chain lengths outside the experimental range can be predicted. The distance travelled by the adsorbate molecules, obtained by integration of the exponential equation, agrees closely with that deduced directly from Gibbs' equation, and provides support for the adsorption mechanism proposed. The results can be used to assess the probable constancy of the migrational velocity at concentrations lower than those which can be studied experimentally.

532.612.4 : 532.613.4 2799

Minima in surface-tension and interfacial-tension curves. MILES, G. D. *J. Phys. Chem.*, 49, *pp.* 71–76, *March*, 1945.—The interfacial-tension/conc. curve for solutions of pure Na lauryl sulphate (A) against C_6H_6 shows no pronounced min., but a mixture of solutions of (A) and pure Na heptadecane-2-sulphate, 100 moles to 1, exhibits a pronounced min. against C_6H_6. Min. were produced by deliberate "contamination" of solutions of pure, surface-active primary or secondary alcohol sulphates with a second surface-active material. In all cases, attempts at selective adsorption at either an air–liquid or a C_6H_6–liquid interface showed that these min. occur at bulk concs. where the relative surface conc. of the minor component is at a max.

It is suggested that the selective adsorption technique used might be of value as a test to ascertain if any min. in the curves exist for systems supposedly containing only one surface-active component. [See Abstr. 1277 (1944)]. N. M. B.

532.613.4 2800

Rupture of water drops over liquid surfaces. SAHAY, B. K. *Indian J. Phys.*, 18, *pp.* 306–310, *Dec.*, 1944.—The critical height to produce rupture of water drops of different sizes over oils and their mixtures have been observed. A linear relation is found to exist between the critical height and the reciprocal of the mass of the drop, for a given liquid. The variation of the critical height for a particular size of the drop with different liquids of different viscosities, shows a distinct minima in each case of the experimental curves. The surface tension, interfacial surface tension, and density of the oils have also been measured, and these may throw light on the true mechanism of the rupture of water drops. [See Abstr. 2128 (1944)].

532.613.4 : 532.612.4 *see Abstr.* 2799

532.63 2801

Elastic recovery in capillary flow. MERRINGTON, A. C. *Nature, Lond.*, 155, *p.* 669, *June* 2, 1945.

532.64 2802

The significance of the contact angle in relation to the solid surface. PEASE, D. C. *J. Phys. Chem.*, 49, *pp.* 107–111, *March*, 1945.—It is shown that the junction of an air-liquid interface with a solid surface is fundamentally a one-dimensional system. This line of junction can occupy various possible parallel positions on the plane of the solid surface, and different positions allow different mean works of adhesion depending upon the configuration of the different groups exposed on the solid surface. The equilibrium contact angle is related directly to the line of least possible mean work of adhesion that the three-phase junction can assume. The receding contact angle is related directly to the line of greatest possible mean work of adhesion. The advancing contact angle is dependent upon the greatest possible amount of work necessary to wet the solid surface. This, in turn, is inversely related to the least possible mean work of adhesion.

532.64 2803

The rarity of zero contact angles. GANS, D. M. *J. Phys. Chem.*, 49, *pp.* 165–166, *March*, 1945.

532.64.08 2804

Equilibrium relationships between fluid interfaces: the system methylene iodide–water–air. FOX, W. *J. Amer. Chem. Soc.*, 67, *pp.* 700–703, *May*, 1945.—The equilibrium angles through each of the three fluid phases for the mutually saturated system CH_2I_2–water–air meeting at a common edge were directly measured. W. R. A.

532.69 2805

The equilibrium spreading coefficient of amphipathic organic liquids on water. HEYMANN, E., AND YOFFE, A. *J. Phys. Chem.*, 49, *pp.* 239–245, *May*, 1945.—A theoretical discussion concerning the equilibrium spreading coefficient of amphipathic organic compounds on water is given, with particular reference to intermolecular forces and the work of orientation. The experimental material is briefly reviewed.

532.694.1 : 532.51 2806

Foam drainage. MILES, G. D., SHEDLOVSKY, L., AND ROSS, J. *J. Phys. Chem.*, 49, *pp.* 93–107, *March*, 1945.—The flow characteristics were studied of liquid in foams of relatively uniform bubble size and uniform liquid conc. without concomitant foam breakdown. The rates of drainage of liquid from these foams were measured and shown to approach an approximate simplified equation corresponding to liquid flow in a vertical capillary. The rates of flow of liquid were measured as a function of the liquid held in the foam, and an empirical equation in accord with these data is given. The rates of flow of liquid through foams decrease with increase in both surface and bulk viscosities as well as for smaller bubble sizes. Differences in flow characteristics through stable foams are more pronounced at certain temperatures. Attempts to evaluate foam stability from foam drainage rates reported in the literature are not considered generally valid.

532.7 : 537.57 2807

Activation energy of ionic migration in molten salts. HEYMANN, E., AND BLOOM, H. *Nature, Lond.*, 156, *pp.* 479–480, *Oct.* 20, 1945.

532.72 : 532.61 *see Abstr.* 2796

532.73 : 542.61 : 519.21 2808

A contribution to the theory of systematic extraction and other related convection problems. STENE, S. *Ark. Kemi Min. Geol.*, 18*A*, 4–5, *No.* 18, 121 *pp.*, 1945.—The mathematical treatment is based on the fact that the molecules of the solute are distributed between 2 immiscible solvents according to the theory of probability. Both phases are supposed to be dilute solutions, where the partition ratio of the solute is constant. Under simplifying conditions, such as may occur in practice, the distribution by systematic extraction with a quiescent phase as a foundation has the binomial and the Pascal distributions with the limiting cases the Poisson and the normal distributions. Discontinuous countercurrent extraction could not be treated by simple expressions owing to difficulty in the partial summation of a hypergeometric series. A method for the numerical evaluation in given cases is described. By semicontinuous countercurrent extraction the exact distribution is given with approximations for systems with a large number of sections. The conditions for optimum separation of the constituents of a mixture are discussed.

532.733 2809

The solubility of silver acetate in mixtures of ethyl alcohol and water. The formation of complex ions. MACDOUGALL, F. H., AND ALLEN, M. *J. Phys. Chem.*, 49, *pp.* 245–260, *May*, 1945.—Measurements were made of the solubility at 25°C. of Ag in the presence of Na and K acetates, $AgNO_3$, and $AgClO_4$ in 10, 20, and 30% EtOH. The apparent solubility product of Ag acetate in the presence of any one of the 4 electrolytes mentioned is greater, for a given apparent ionic strength, than when the added electrolyte has no ion in common with Ag acetate. The apparent inapplicability of the Debye theory can be explained quantitatively by assuming the formation of the complex ions Ag_2A^+ and AgA_2^-. The activity product of Ag^+ and A^- and the dissociation constants

AgA_2^- and of Ag_2A^+ in various solvents were termined. The acetatodisilver ion is more ;ble than the diacetatoargentate ion. The Born uation leads to values of the ionic radii which are the right order.

2.739.2 2810

The improvement of the citric-acid solubility of basic en-hearth slags containing fluorspar. PEARSON, F. *J. Iron Steel Inst.*, 13 *pp.*, *May*, 1945. *Advance py.*—Brief mention is made of the citric-acid lubility test for basic slags. Preliminary experi-ental work was conducted to discover the effect of tenching, and it was found by this means that the lubility could be increased. Results obtained from ntering experiments prompted full-scale trials in the tside.

2.74 2811

Association of some organic acids in benzene solution. ALL, F. T., AND BANES, F. W. *J. Amer. Chem. Soc.*, *l*, *pp.* 898–899, *June*, 1945.—The associations of enzoic, *o*-toluic and *m*-toluic acids in benzene olution were measured at 32·5, 43·4 and 56·5°C. an isotensimeter. Phenanthrene was used as the andard unassociated substance and Raoult's law as assumed to be valid. Benzoic and *m*-toluic acids sociate to approx. the same extent, but appreciably ore than *o*-toluic acid at a given temperature. The eats of dissociation of the acid dimers were calculated id found to be of the order of 9 k.cal. with *m*-toluic id > benzoic acid > *o*-toluic acid. W. R. A.

32.782 : 536.7 2812

Kinetics of precipitation in Pb–Sn alloys. BORELIUS, ., LARRIS, F., AND OHLSSON, E. *Ark. Mat. Astr. ys.*, 31*A*, 10, 19 *pp.*, 1944.—Describes experiments arried out on Pb–Sn alloys with a view to testing a heory of precipitation suggested by Borelius [see bstr. 356 (1939)] according to which the velocity of recipitation depends on the degree of thermal uctuations. Electrical resistivity measurements ade at increasing temperatures are used for a new etermination of the two-phase boundary. This curve used for the evaluation of the free energy on the asis of Borelius' equations, and other deductions llow from the form of this curve. The theoretical alues derived for the velocity of precipitation are in ccord with experimental values obtained in terms f the change in resistivity with time, the specimen eing first homogenized at 180°C. and then quickly ransferred to various lower temperatures. These esistance-time curves at constant temperature show n abrupt change in slope which is not yet completely nderstood, but is thought may be associated with wo stages of precipitation revealed for other alloys by -ray analysis. R. W. P.

32.782 : 536.7 2813

On the fluctuations producing nuclei in super-cooled olid solutions. BORELIUS, G. *Ark. Mat. Astr. Fys.*, 2*A*, 1, 9 *pp.*, 1945.—A further theoretical treatment f the results of the previous paper [Abstr. 2812 (1945)] which indicates the number of atoms in the fluctuating roup forming the first stage of the precipitation to be f the order of 120. This number is much less than he X-ray measurements of Guinier and Preston uggest. R. W. P.

532.782 : 669.018 2814

On the constitution of aluminium–magnesium–manganese–zinc alloys: the solidus. BUTCHERS, E., AND HUME-ROTHERY, W. *J. Inst. Met.*, 12, *pp.* 291–311, *June*, 1945.—The solidus and liquidus curves for the α-solid solution of Al–Mg were determined accurately down to the temperature of the $\alpha + \beta \rightleftharpoons$ liquid eutectic. The corresponding curves for the system Al–Zn were determined over a wide range of compositions. The liquid ⇌ solid equilibrium of each system at small concentrations agrees with what would be predicted from the known latent heat of fusion of Al. The 630° and 550°C. liquidus isothermals for the α-solid solution of Al–Mg–Zn were determined accurately. The solidus isothermals of Al-rich alloys were determined for Al–Mg–Zn, Al–Mg–Mn and Al–Mn–Zn, and for Al–Mg–Mn–Zn.

[533.12 + 536.423.15] *see Abstr.* 2980

533.15 2815

Sorption of fumigants. LUBATTI, O. F. *Nature, Lond.*, 155, *p.* 577, *May* 12, 1945.—Deals with sorption of organic vapours on wheat.

533.15 2816

Effect of pressure on thermal diffusion in gases. GREW, K. E. *Nature, Lond.*, 156, *pp.* 267–268, *Sept.* 1, 1945.

533.275 2817

Time lag and humid fatigue of hygrometers. MAHAJAN, L. D. *Indian J. Phys.*, 18, *pp.* 293–302, *Oct.*, 1944.—Contains results for the effect of humidity changes on various hygrometers, including the author's optical hygrometer. This contains a mixture of about 1% $CaCl_2$, 9% plaster of Paris and 90% small pieces of hair. The time lag depends on their construction, the rate of air circulation and their immediate past history. The Mahajan hygrometer has a time lag of about 16 min., the lowest of those tested. R. W. P.

533.275 2818

Equilibrium humidity measurement. VINCENT, J. F., AND BRISTOL, K. E. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 465–466, *July*, 1945.

533.275 : 631.81 2819

Moisture relations of mixed fertilizers. Influence of nitrogenous materials. HARDESTY, J. O., YEE, J. Y., AND LOVE, K. S. *Industr. Engng Chem.*, 37, *pp.* 567–573, *June*, 1945.

533.275 = 3 2820

The diffusion hygrometer. GREINACHER, H. *Helv. Phys. Acta.*, 17, 6, *pp.* 437–454, 1944.—The differences between the diffusion rates of air and water vapour through porous plates are used in a new diffusion hygrometer. Two glass vessels, each closed at one end with a porous plate, are connected at the other end to separate manometers or to the same manometer through a three-way tap. Air can pass freely through these plugs and the air pressure is the same inside and outside the vessels. Water vapour can pass less easily and a diffusion pressure is set up. One vessel contains water and the pressure excess is proportional to the difference between the saturated vapour pressure and the partial vapour pressure in the outside air. The other vessel contains a drying medium and the excess pressure is proportional to the partial vapour pressure only. Comparison with other instruments,

the behaviour under various conditions, and the construction of an indicating instrument based on these principles are discussed. E. H. D.

533.5 2821

A greaseless magnetic valve for high vacuum systems. ARMSTRONG, D. L. *J. Amer. Chem. Soc.*, 67, *p.* 686, *April*, 1945.—A double-plug arrangement of a magnetically operated 2-way valve is described. The valve maintained a pressure of 900 mm. on one side and a vacuum on the other with $<0{\cdot}05$ cm.^{3} leakage in 10 min. W. R. A.

533.5 2822

A high vacuum cut-off. SERFASS, E. J., AND MURACA, R. F. *Rev. Sci. Instrum.*, 16, *p.* 225, *Aug.*, 1945.

533.5 2823

Making very thin vacuum-tight glass windows. ROSENBLUM, S., AND WALEN, R. *J. Sci. Instrum.*, 22, *pp.* 196–197, *Oct.*, 1945.

533.5.081 2824

Unit for degree of vacuum. TOWNSEND, F. H. *Nature, Lond.*, 155, *pp.* 545–546, *May* 5, 1945.—A new unit is proposed, based on the log. of the pressure in mm. Hg. Correspondence by R. Feinberg and G. A. P. Wyllie appears in *Nature*, 156, p. 85, July 21, 1945.

533.5.081 2825

Logarithmic scales. ROSE, F. C. *Nature, Lond.*, 156, *p.* 268, *Sept.* 1, 1945.—[See Abstr. 2824 (1945)].

533.56 2826

Ultimate vacuum attainable by a diffusion pump. RAY, K., AND SENGUPTA, N. D. *Nature, Lond.*, 155, *p.* 727, *June* 16, 1945.

533.56 : 621.385.833 2827

Small oil diffusion type vacuum pump. BACHMAN, C. H. *Rev. Sci. Instrum.*, 16, *p.* 153, *June*, 1945.—The pump is used in evacuating a portable electron microscope. It is easily made in Pyrex and operates with any of the pump oils now available on the market. The speed is approximately 2 litres per sec. and vacua of better than 10^{-5} mm. of Hg have been maintained quite easily in such applications as X-ray diffraction units, bell jars for evaporation processes, etc.

533.6.011 : 536.2 = 82 2828

Resistance of, and heat transfer from, a flat plate in a high-velocity gas stream. KALIKHMAN, L. *Appl. Math. Mech.*, 9, *pp.* 245–256, 1945.—A study is made of the laminar and turbulent boundary layers of gas flow around a flat plate with heat exchange. Formulae are derived for resistance and heat transfer, velocity and temperature distribution, heat content and dissipation of the gas. Limiting Mach numbers are determined beyond which the plate will lose its cooling action on the heated gas, or conversely.

E. R. A.

533.6.011.3 2829

Faster than sound. VON KÁRMÁN, T. *J. Wash. Acad. Sci.*, 35, *pp.* 144–155, *May*, 1945.—When the speed of aircraft is $>{}^2/_3$ the velocity of sound, the discrepancy between actual phenomena and theory (air regarded as incompressible fluid) can no longer be removed by small corrections, and the air must be treated as a compressible fluid. The speed of projectiles may be several times the vel. of sound, but difficulties appear in the trans-sonic range just abo and below this velocity. Two basic problems a considered: the flow of a fluid in a conduit and t motion of a solid in a fluid at rest. The efflux of gas through a simple rounded orifice on the wall of pressure vessel is such that with pressure differen increase the outflow lags behind the Torricelli valu also, at a certain critical pressure ratio the efflux ra reaches a max. With a converging-diverging nozz and a pressure ratio > the critical, a supersonic flow obtained; but with the main flow supersonic, that ne the wall is subsonic and the fluid behaves different in the two cases. The example is next taken of a boc of revolution at rest in a gas moving past it with supe sonic velocity. In the purely subsonic case the drag due partly to friction and partly to form. The dra increases rapidly as the velocity passes that of soun With an aeroplane wing moving through air at res similar phenomena occur as are observed in nozzle if the vel. of sound is reached in the throat the rate flow through the nozzle cannot be increased, and the downstream pressure is higher than corresponds t the expansion ratio of the nozzle, a compression shoc results. In the case of the moving wing the first caus a decrease of the lifting capacity, and the secon increases the drag. The throat condition occurs earli on the upper surface of the wing and the lift becom independent of the vel. of flight, and the lift coef decreases rapidly. Photographs show that simu taneously with the occurrence of the shock wave th flow separates from the wing surface causing increase drag. G. E. A

533.6.015 : 531.55 283

Optimum height of flight of winged rocket- or je bomb. KRZYWOBLOCKI, M. Z. L. *J. Appl. Phys.* 16, *pp.* 275–279, *May*, 1945.—The elementary prin ciples of rocket-propulsion are given. The horizont flight of a rocket in atmosphere at a certain height i considered and the formulae for the optimum heigh of flight are derived for (*a*) constant velocity of fligh (*b*) constant mass of the outflowing gases. Th calculations refer to the case of adiabatic flow in th nozzle but may be applied to the case of any polytropi flow. The considerations are repeated in the sam order for jet-propulsion. The formulae are derive under the assumption that the difference in pressure in the wake behind the bomb in flight—in which th pressure is smaller than in the free air—and in the fre air may be disregarded.

533.6.07 : 621.34 : 621.313.333.1–181.2 283

40 000 h.p. motor drive for army wind tunne *Pwr Plant* (*Engng*), 46, *pp.* 87–89, *July*, 1942.—[Abstr 2461 B (1945)].

533.6.071 = 3 283

Pressure drop in branches of air tunnels of squar cross-section. IBRAHIM, M. A., AND HASSAN, M. A *Schweiz. Bauztg*, 124, *pp.* 48–50, *July* 22, 1944.—The experimental determination of the pressur drop in branched wind tunnels is described and dis cussed. The greater the diversion which a give stream suffers the higher the coefficient of loss whereas the coefficient of loss in an unbranche tunnel depends only on this quantity passing. W. A. R

533.73 283

The energies of uniformly accelerated particles i a gas. YARNOLD, G. D. *Phil. Mag.*, 36, *pp.* 185–199

March, 1945.—The distribution of the energies is studied by means of some statistical experiments carried out on 5 groups, each of 200 particles. A comparison of the results is made with the theoretical distributions proposed by Townsend [Abstr. 3823 (1930)] and Druyvesteyn [Abstr. 1298 (1936)]. The agreement is better with the former distribution.

L. S. G.

534.013 : 621.43 2834

Torsional vibration in internal combustion engines. BERMAN, L. *Engl. Elect. J.*, 10, *pp.* 218–222, *June*, 1945.—A method of calculating amplitudes and natural frequency, including Carter's empirical formula for crankshafts is briefly described. Methods of reducing vibrations are enumerated and drawings of vibration dampers given. R. G. J.

534.015 : 621.396.611.3 2835

Gyroscopic coupling terms. JEFFERSON, H. *Phil. Mag.*, 36, *pp.* 223–224, *March*, 1945.—It is explained how certain difficulties arising in a paper by Bloch [Abstr. 2399 (1944)] may be avoided by an electrical analogy of gyroscopic coupling. This analogy is derived by means of circuit matrices [Abstr. 1057 B (1945)]. L. S. G.

534.121.1 2836

High frequency vibrations of thin crystal plates. EKSTEIN, H. *Phys. Rev.*, 68, *pp.* 11–23, *July* 1 *and* 15, 1945.—The boundary conditions of free vibration can be satisfied on the major surfaces of a plane-parallel plate if the displacement components are assumed to be products of trigonometric functions. The conditions can be approx. satisfied on the minor surfaces when the plate is thin. The theory leads to a frequency equation $\nu = \frac{1}{2}(c/\rho)^{\frac{1}{2}}[(n/2b)^2 + k(m/2a)^2]^{\frac{1}{2}}$ which has been found empirically to satisfy observations. The theoretical values of the constant k are 3·7 and 1·8 for the *AT* and *BT* quartz plates, respectively, while the observed values are 3·9 and 1·7, respectively.

534.13 : 621.392.1 : 517.53 2837

Transmission, reflection, and guiding of an exponential pulse by a steel plate in water. I. Theory. OSBORNE, M. F. M., AND HART, S. D. *J. Acoust. Soc. Amer.*, 16, *pp.* 1–18, *July*, 1945.—The problem of the interaction of an underwater explosion wave with a steel plate is discussed, particularly those aspects in which the plate can be considered as an elastic, 2-dimensional wave-guide. The phase velocities of the more important modes of the plate are evaluated as functions of frequency. They are used to derive the properties of the precursor, an oscillation which precedes the explosion wave as it travels along the plate. The results of the theory are compared with experiment. The methods are applicable to the evaluation of the phase velocities of the modes of an electromagnetic-wave guide. The propagation of a transient, such as an explosion wave, down a wave guide, presents the mathematical problem of the evaluation of a contour integral of a function of a complex variable defined implicitly. No rigorous solution as yet exists.

534.13 : 621.396.6 : 629.135 2838

Anti-vibration mountings for aircraft radio equipment. HONNOR, W. W. *A.W.A. Tech. Rev.* [*Amal. Wireless Aust.*], 6, 6, *pp.* 291–309, 1945.—The general effects of aircraft vibration on radio equipment are discussed. The frequencies and amplitudes of vibration likely to be experienced in aircraft are indicated, and the standard vibration tests laid down by Civil Aviation Authorities are given. The characteristics of the "Lord" type of anti-vibration unit are discussed, and it is shown that the vibration attenuation ratio calculated for this type of unit by neglecting the damping factor and assuming that the static modulus of elasticity applies under conditions of vibration is erroneous. A method is developed for determining the damping factor and dynamic modulus of elasticity; calculated and measured values of attenuation ratios for a range of frequencies are given for a number of samples of the "Lord" type anti-vibration mounting unit.

534.13 : 621.434 : 629.123 2839

Vibration problems in the design of marine oil engines. WOODHEAD, E. H. *Trans. Instn Engrs Shipb. Scot.*, 88, *pp.* 373–390, *June*, 1945.—An essay on the factors affecting ship vibration set up by reciprocating engines, including the calculation of frequency and damping. W. W. C.

534.131 : 621.3.012.8 : 621.317.39 2840

A new device for the solution of transient-vibration problems by the method of electrical-mechanical analogy. CRINER, H. E., MCCANN, G. D., AND WARREN, C. B. *J. Appl. Mech.*, 12, *A*135–*A*141, *Sept.*, 1945.—[Abstr. 2438 B (1945)].

534.133 : 621.396.611.21 : 537.228.1 *see Abstr.* 3011

534.143 2841

Production of difference tones. ALLEN, F. *Nature, Lond.*, 156, *pp.* 84–85, *July* 21, 1945.

534.15 : 535.89 : 621.396.615.17 2842

The photopulse. THOMAS, E. L. *Electronic Engng*, 17, *pp.* 409–412, *March*, 1945.—[Abstr. 2657 B (1945)].

534.21 : 536.48 *see Abstr.* 2986

534.321.9 2843

Wave-front determination in a unidirectional supersonic beam. LABAW, L. W. *J. Acoust. Soc. Amer.*, 16, *pp.* 19–23, *July*, 1945.—A method was developed to determine the loci of equal phase in a h.f. compressional wave beam in liquids without using standing wave patterns. The wave-front in a supersonic beam may thus be determined simultaneously with the relative excess pressure amplitude. The electric signal generated by the piezoelectric action of a Rochelle salt microphone which has the phase of the compressional wave in the liquid is combined with a small electric signal of the same frequency having the phase of the voltage impressed across the quartz generator. The result of this superposition is an approximately sinusoidal spatial variation of the signal generated by the microphone as the latter is moved in the direction of propagation of the beam. The wave-front may be traced by following a max. of this sinusoidal variation as the microphone is moved at rt. angles to the direction of propagation. The frequency used was about 1 200 kc/s.

534.372 : 531.383 : 621.3.012.8 : 629.135 2844

Damping cylinders for aircraft gyroscopes. SIAS, F. R., AND WRIGHT, J. H. *Trans. Amer. Inst. Elect. Engrs*, 63, *pp.* 979–985, *Dec.*, 1944. *Suppl.*—The gyroscope in an artificial horizon indicator for aircraft

requires damping. Oscillations in the controlling pendulum system are transient where due to external shock or motion, but more sustained by the additional interaction of the erecting magnet with the erecting disc. Air damping cylinders are fitted because their size is small and an initial displacement is necessary before damping takes effect. Elasticity is thereby added to the rotational system, and depends on air pressure as does the friction. For design, the mechanical system is translated into an electric circuit; the latter is subjected to analysis and experiment, the parameters being varied to simulate the range of pressures. The correct damping constant is derived, approximating critical damping over the range; this leads directly to the clearance between cylinder and piston diameters to be used. T. J. R.

534.522.1 : 534.614 : 534.845.1 = 3 2845

The measurement of the velocity and absorption of ultrasonics by an optical method. BÖMMEL, H. *Helv. Phys. Acta*, 18, 1, *pp.* 3–20, 1945.—The measurement of the velocity of ultrasonics in gases becomes more complex as the frequency increases, on account of the interaction between source and receiver and other effects. In the optical method described the Hg 4 358 Å line is passed through gas subjected to the action of the ultrasonics, and the diffraction pattern brought to a focus on a photographic plate by a concave mirror. The velocity V is obtained from the separation of the diffraction maxima. A range of 951–4 755 kc. is covered. A method is worked out theoretically whereby the absorption can be obtained from the separation of the diffraction maxima. E. H. D.

534.611 2846

Acoustical impedance of fog. GHOSH, R. N. *Indian J. Phys.*, 18, *pp.* 341–346, *Dec.*, 1945.—The impedance of air containing water particles in suspension is calculated directly from the hydrodynamical laws. The resulting formula is practically the same as that for solids.

534.612 2847

A working standard for sound pressure measurements. MASSA, F. *J. Acoust. Soc. Amer.*, 16, *pp.* 29–34, *July*, 1945.—The design and characteristics of a new microphone are described. It is stiffness-controlled and has an acoustic impedance approx. equal to 0·001 cm.^{3} of air throughout the entire audio-frequency range up to 20 kc/s. The structure approximates a rigid cylinder, $^5/_8$ in. dia. × $^{15}/_{16}$ in. long and is linear to sound pressure measurements up to several million dynes/cm.^{2}

534.614 : 534.845.1 : 534.522.1 = 3 *see Abstr.* 2845

534.632.082 : 621.396.616 2848

A frequency standard for use at high and low frequencies. MCLOUGHLIN, R. P. *J. Acoust. Soc. Amer.*, 16, *pp.* 46–70, *July*, 1945.—A secondary standard is described consisting of a tuning-fork oscillator controlling an Abraham and Block multivibrator. An amplifier of adequate selectivity allows the selection of any harmonic of the fundamental voltage. This is accomplished by the use of a multivibrator and a regenerative amplifier of high selectivity allowing selection of any harmonic of the fundamental frequency in the band 1 kc/s to 2 Mc/s. The tuning-fork oscillator has the advantages: (1) Possibility of frequency adjustment by varying the amplitude of tuning fork oscillation. (2) Automatic adjustment of the amplitude to the desired value. (3) Automatic adjustment of the phase difference between the amplitude and the applied force. (4) Visual indication of amplitude. (5) Visual indication of the ph. difference. (6) Possibility of manual adjustment of the ph. difference. These properties permit indirect measurement of the frequency at any moment making it possible to change tubes without recalibration by comparison with a primary standard.

534.642 2849

Application of the wave-theory of room acoustics to the measurement of acoustic impedance. HARRIS, C. M. *J. Acoust. Soc. Amer.*, 16, *pp.* 35–45, *July*, 1945.—A method is given for the measurement of acoustic impedance of large areas of material, at l.f., under actual mounting conditions and at various angles of incidence. It is used to verify the assumption in the wave-theory of room acoustics that the boundary conditions for the sound field can be expressed in terms of a normal acoustic impedance which is not a function of angle of incidence. The impedance of material covering a wall is computed from 2 of the room's acoustic properties, the decay constants and frequencies of the normal modes of vibration. Thus the impedance of a large area vibrating as a panel may be measured where determinations by methods using small samples are not applicable. By using large areas, the average impedance of a number of small samples may be obtained at once. The new method has the advantage that a direct check of this impedance value may be secured by measurements of pressure distribution of the normal modes.

534.75 : 621.396.81 2850

Tonal-range and sound-intensity preferences of broadcast listeners. CHINN, H. A., AND EISENBERG, P. *Proc. Inst. Radio Engrs, N.Y.*, 33, *pp.* 571–581, *Sept.*, 1945.—[Abstr. 2677 B (1945)].

534.771 : 612.85 2851

Group audiometry. HARRIS, J. D. *J. Acoust. Soc. Amer.*, 16, *pp.* 73–76, *July*, 1945.—Apparatus is described for a group test of auditory acuity as a function of frequency. Reliability is only slightly less than that of a careful individual examination. The techniques which produce highest reliability are described. Validity is satisfactory in terms of deviation from results of an individual test. Several checks on malingering are provided which make group audiometry practicable with populations not highly selected for age or intelligence.

534.773.2 : 621.395.645.34.029.3 2852

Negative feed-back in hearing aid amplifiers. PLANER, F. E., AND MARLAND, E. A. *Electronic Engng*, 17, *pp.* 450–453 *and* 455, *April*, 1945.—[Abstr. 2638 B (1945)].

534.837 : 621.831 2853

Why does a gear sing? How can the singing be avoided? MELDAHL, A. *Brown Boveri Rev.*, 29, *pp.* 284–289, *Sept.–Oct.*, 1942.

534.845.1 : 534.614 : 534.522.1 = 3 *see Abstr.* 2845

534.845.1/.2 2854

Observed classical sound absorption in air. PIELEMEIER, W. H. *J. Acoust. Soc. Amer.*, 16, *pp.* 24–28, *July*, 1945.—A brief treatment of the theory and

methods of measuring absorption of sound in gases precedes graphical data. The measurements were made with a Pierce acoustic interferometer at a frequency of 1 927 kc/s in air. This frequency is high enough to satisfy Hardy's and Krasnooshkin's required conditions to obtain reliable results. The experimental result agrees with Krasnooshkin's value of $\alpha_0\lambda_0^2 = (225 \pm 5)\times 10^{-6}$ cm.

535 : 548.0 *see Abstr.* 3119

535–1 : 530.145.6 : 548.0 *see Abstr.* 3120

535.13 : 517.947.44 : 513.813 2855

Development of electromagnetic theory for non-homogeneous spaces—a correction. LIEBOWITZ, B. *Phys. Rev.*, 67, *pp.* 364–365, *June* 1 *and* 15, 1945.—[See Abstr. 863 (1944)].

535.13 : 519.2 2856

The statistical properties of unpolarized light. HURWITZ, H., JR. *J. Opt. Soc. Amer.*, 35, *pp.* 525–531, *Aug.*, 1945.—In a beam of monochromatic unpolarized light the electric field vector at a point traces out an ellipse whose size, eccentricity and orientation are slowly varying functions of time. The statistical properties of the parameters of this ellipse are investigated. It is shown that the quantity S which is defined as $2\times$ product of the principal axes of the ellipse ÷ the sum of the squares is uniformly distributed between 0 and 1. It therefore has median value $^1/_2$ which corresponds to a minor/major axis ratio of 0·268. Hence fairly thin ellipses predominate. The square root of the sum of the squares of the semi-major and semi-minor axes, R, is statistically independent of S and has the distribution function $(r^3/2p^4)\exp(-r^2/2p^2)$ where $2p^2$ is the average value of R^2.

535.21–31 : 576.893.12 2857

The effect of ultra-violet radiation on cysts of endamoeba histolytica. STOLL, A. M., WARD, P. A., AND MATHIESON, D. R. *Science*, 101, *pp.* 463–464, *May* 4, 1945.

535.215 : 539.16.08 = 4 2858

Photoelectric measurements on liquids using the spark counter. JEANGUENIN, P. *Helv. Phys. Acta*, 17, 5, *pp.* 319–345, 1944.—The adaptation of the Greinacher spark counter to measure the photoelectric effect with liquids is described. A jet of liquid is used, giving the advantage of always presenting a fresh surface. It is better to use a vertical rather than a horizontal jet. The effect of the high tension and position of the anode on the working of the apparatus is investigated. The counter works with a liquid jet electrode, but not with a moistened solid electrode. The comparative photoelectric effect was determined for a large number of acids, bases, and salts in aqueous solution. The most active were potassium ferrocyanide and ferricyanide, and the carbonates and iodides of Li, Na, and K. The effect varies linearly with concentration. Potassium ferrocyanide was investigated over the range 210–250 mμ; there is probably a maximum at ~220 mμ. In the case of carbonates, the activity appears to diminish with time, the anomaly being probably due to the dissolution of silicates from the glass, and subsequent formation of a colloidal solution. A. J. M.

535.215 : 612.11 : 535.65 *see Abstr.* 2958

535.215.2 2859

Theory of photoelectric emission from metals. FAN, H. Y. *Phys. Rev.*, 68, *pp.* 43–52, *July* 1 *and* 15, 1945.—The theory of volume effect is developed. Formulae are derived for the rate of electron excitation and for the photoelectric yield. The calculated threshold frequencies for volume effect are $5\cdot91\times10^{14}$ and $5\cdot69\times10^{14}$ for Na and K respectively. The estimated photoelectric yields for these metals are of the same order as those calculated for surface effect and are comparable with experimental values. The volume effect should not, therefore, be neglected except in the immediate neighbourhood of the threshold frequency. Approx. estimation indicates that light absorption of Na and K in the visible and ultra-violet regions should be largely due to quantum excitation of electrons.

535.23.08 2860

Steady-state sensitivity of a vacuum bolometer. AMDUR, I., AND GLICK, C. F. *Rev. Sci. Instrum.*, 16, *pp.* 117–124, *May*, 1945.—The theory of the steady-state sensitivity of a vacuum bolometer as a function of operating temperature is developed from exact heat flow equations which take into account losses by wire conduction as well as by radiation, and increase of bolometer resistance with temperature. Sensitivities predicted by the present theory differ by >50% from those of an earlier theory in which the effects of wire conduction and of increase of bolometer resistance with temperature were neglected. Experimental sensitivities agree with values calculated. The method of extending the theory to predict steady-state sensitivities of bolometers, not operated in vacuum, is given for the pressure region where free molecule conduction predominates.

535.232 : 523.72 : 621.396.822 2861

Departure of long-wave solar radiation from black-body intensity. APPLETON, E. V. *Nature, Lond.*, 156, *pp.* 534–535, *Nov.* 3, 1945.

535.234 : 535.241.44 *see Abstr.* 2862

535.241.44 : 535.234 2862

The relation between the brightness and temperature of a total radiator. CALDIN, E. F. *Proc. Phys. Soc., Lond.*, 57, *pp.* 440–443, *Sept.*, 1945.—Values are calculated for the brightness of a total radiator at temperatures of 2 000°–3 120°K., using the standard C.I.E. relative luminosity curve and the Planck radiation law. A simple logarithmic equation is found to express the relation between brightness and temperature to within ±1% over this range. The ratio of the new international candle to the lightwatt is calculated.

535.243 2863

Spectrophotometric method for determining formaldehyde. BRICKER, C. E., AND JOHNSON, H. R. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 400–402, *June*, 1945.

535.243 2864

Uses of retardation plates in spectrophotometry. I. Determination of slit shape and slit width. II. Calibration of wave length. III. Measurement of dichroic samples. BUC, G. L., AND STEARNS, E. I. *J. Opt. Soc. Amer.*, 35, *pp.* 458–470, *July, and pp.* 521–524, *Aug.*, 1945.—A retardation plate is used to make a

calibrator having a known transmission curve. It is shown how the effect of slit width and slit shape on the plotted transmission of the calibrator can be predicted, and conversely how the width and shape of an assumed slit may be evaluated from the performance of a spectrophotometer in plotting the transmission of the calibrator. If it is assumed that the slit is trapezoidal, it is recommended that it be described on an over-all performance basis in terms of two factors, H the slit width and f the shape factor. Assuming that a correctly calibrated spectrophotometer will give the same transmission curve for straight-line absorptions as would be obtained with monochromatic light, the calibrator may be used for wavelength calibration with an error of $<1\%$ of slit width. Specific recommended calibration procedures are given. A theory of retardation plate flickering is presented. The behaviour of rotating plane of polarization spectrophotometers with dichroic samples is formulated. It is shown that polarized beam spectrophotometers modified by the addition of a thick retardation plate will duplicate the results of absorption measurements on dichroic samples obtained with unpolarized light.

535.243 2865

Direct intensity measurements of spectrum lines with photo-multiplier tubes. DIEKE, G. H., AND CROSSWHITE, H. M. *J. Opt. Soc. Amer.*, 35, *pp.* 471–480, *July*, 1945.—The disadvantages of photographic methods for measuring the intensities of spectrum lines are discussed and the use of a direct photoelectric method is described. Photo-multiplier tubes are an essential part of the set-up and enable the technique to be used for relatively weak lines. The results given were obtained with a 21 ft. grating in a Wadsworth mounting. The resolving power obtained is the same as that obtained photographically whilst the sensitivity range is much greater than that of the photographic plate. Applications to industrial spectroscopy are indicated. A. H.

535.243 : 535.34 *see Abstr.* 2908

535.243 : 545.81 2866

Colorimetric determination of nickel with dimethylglyoxime. MITCHELL, A. M., AND MELLON, M. G. *Industr. Engng Chem.* (*Analyt. Edit.*), 17, *pp.* 380–382, *June*, 1945.—A spectrophotometric study was made of the colorimetric method involving formation of a soluble red complex by treating the Ni ion with ammoniacal dimethylglyoxime. Beer's law applies for concs. from 0·1–5 p.p.m. of Ni, using 1 000 cm. absorption cells. The aqueous system is unstable, but sufficient ethanol makes the colour stable for 30 min.

535.243 : 545.81 2867

Colored TNT derivative and alpha-TNT in colored aqueous alpha-TNT solutions. Spectrophotometric procedure for quantitative estimation. RUCHHOFT. C. C., AND MECKLER, W. G. *Industr. Engng Chem*, (*Analyt. Edit.*), 17, *pp.* 430–434, *July*, 1945.—A simple analytical procedure was developed for the determination of TNT in uncoloured aqueous solutions, applicable to polluted water and sewage samples. A spectrophotometric procedure for quantitative estimation of coloured (combined) TNT fraction and the α-TNT fraction (uncombined) in coloured TNT wastes from shell-loading plants requires determination of extinction values of dilutions of the coloured waste as received at 460 and 505 mμ, and similar determinations at 505 mμ on dilutions after sulphite and hydroxide treatment of the samples.

535.247.4 2868

A simple compensating microphotometer. SPIEGLER, G. *J. Sci. Instrum.*, 22, *p.* 116, *June*, 1945.

535.247.4 2869

A physical photometer for afocal optical systems. MCRAE, D. B. *J. Opt. Soc. Amer.*, 35, *pp.* 510–517, *Aug.*, 1945.—A versatile photometer is described suitable for measurements with instruments which cannot be accommodated on the benches of normal type of photometers. It consists of 3 mechanically independent parts, (1) a light source, (2) a photo-cell receiving device, (3) a meter for reading the output of the photo-cell. Calibration is discussed at length and possible applications examined. A. H.

535.3 : 548.231 : 537.531 *see Abstr.* 3028

535.31 2870

A convenient virtual image locator for elementary optics. TAYLOR, P. K. *Amer. J. Phys.*, 13, *pp.* 167–169, *June*, 1945.

535.313 : 535.317.9 : 621.397 2871

Reflective optics in projection television. MALOFF, I. G., AND EPSTEIN, D. W. *Electronics*, 17, *pp.* 98–105, *Dec.*, 1944.—[Abstr. 2686 B (1945)].

535.316 2872

A simple formula for lens design. MILES, J. R. *J. Opt. Soc. Amer.*, 35, *pp.* 495–496, *July*, 1945.

535.317.6 2873

On tracing rays through an optical system. V. SMITH, T. *Proc. Phys. Soc., Lond.*, 57, *pp.* 286–293, *July*, 1945.—[See Abstr. 1557 (1921)]. An iterative method of tracing rays through an optical system is described, which is suitable for operation by a fully automatic recording machine. The rays may be axial or skew, and the surfaces of any rotationally symmetrical form suitable for optical working. The relation of this method to earlier schemes and the advantages to be gained by successive approximations are considered.

535.317.6 2874

A differential method of adjusting the aberration of a lens system. M'AULAY, A. L., AND CRUICKSHANK, F. D. *Proc. Phys. Soc., Lond.*, 57, *pp.* 302–310, *July*, 1945.—A method is described for computing a highly corrected camera lens system when the general type is given, and a rough design has been made. The method is in two parts: (1) Changes in the rays incident at any surface are expressed as functions of alterations of the surface constants; (2) the ray changes are transferred to the final image space and expressed as changes in the aberrations of the system. Thus a table is obtained using which desired modifications of the aberrations can be achieved by suitable surface alterations.

535.317.6 2875

A transfer method for deriving the effect on the image formed by an optical system from ray changes produced at a given surface. M'AULAY, A. L. *Proc. Phys. Soc., Lond.*, 57, *pp.* 435–440, *Sept.*, 1945.—A method is described depending on the invariance of a function

the position change of successive foci of a narrow ncil as it passes through an optical system. The thod is approx., as the invariant is applied to wide ncils, but by reason of its speed is useful in design. e Abstr. 2874 (1945)].

5.317.6 2876

A system of transfer coefficients for use in the design lens systems: I. The general theory of the transfer efficients. II. A second-order correction term. RUICKSHANK, F. D. *Proc. Phys. Soc., Lond.*, 57, 350–367, *July*, 1945.—An account is given of a ies of differential transfer coefficients which specify changes in the path of a ray in the final image- ce resulting from small changes in surface curva- e, refractive index and axial separation of successive faces, made within the system. Extending the thod to the intersection points of the typical rays a standard trigonometrical trace, transfer coefficients derived specifying the rate of change of the tan- ntial aberrations with curvature, refractive index d axial separation at each surface of the system. particular, coefficients are developed which relate chromatic aberrations very simply to the dis- rsions of the glasses of the system. Expressions are rived for a 2nd-order correction term for the ferential transfer coefficients. Need for the rrection term arises on account of the neglect of the ect of the small change in the direction of the ergent ray during the calculation of the transfer efficients for the intersection points in the final age-space. The correction term is used when the ects of changes in the system beyond differential e are required with increased accuracy. For single anges of this kind in a system, the correction term equently improves the accuracy from the order of 10% to < 1%. Modifications are given for the case which a series of changes are made simultaneously thin the system.

5.317.6 2877

A system of transfer coefficients for use in the design lens systems: III. The contributions to the image errations made by the individual surfaces of a lens stem. CRUICKSHANK, F. D. *Proc. Phys. Soc., nd.*, 57, *pp.* 419–425, *Sept.*, 1945.—A method is scribed for the computation of the contributions the tangential aberrations of the final image for a ncil of finite aperture and obliquity. When applied pencils of small aperture and small obliquity it gives analysis of the surface contributions in exact reement with known primary methods, and thus ovides an extension from the analysis of the primary the trigonometrically determined aberrations. pressions are derived for the contributions to the romatic aberrations made by any component of the stem which are simple functions of the dispersion the component. [See Abstr. 2876 (1945)].

5.317.6 2878

A system of transfer coefficients for use in the design lens systems: IV. The estimation of the tolerances rmissible in the production of an optical system. RUICKSHANK, F. D. *Proc. Phys. Soc., Lond.*, 57, 426–429, *Sept.*, 1945.—A knowledge of the transfer efficients permits the changes in the residual errations to be calculated for any small departure om specified dimensions. Provided the changes are small in comparison with the residuals themselves, the effect of the departure from the specified dimensions will be negligible. Hence the calculated values of the transfer coefficients enable limits to be estimated within which each dimension of an optical system must be controlled.

535.317.6 2879

A system of transfer coefficients for use in the design of lens systems: V. Transfer coefficients for the astigmatism at small aperture and finite obliquity. CRUICKSHANK, F. D. *Proc. Phys. Soc., Lond.*, 57, *pp.* 430–435, *Sept.*, 1945.—Coefficients are developed which specify the changes of the positions of the tangential and sagittal foci in narrow pencils of any obliquity due to small changes in curvature, refractive index, and axial separation.

535.317.6 2880

Exact addition formulae for the axial spherical aberration and curvature of field of an optical system of centred spherical surfaces. BROWN, F. G. *Proc. Phys. Soc., Lond.*, 57, *pp.* 403–411, *Sept.*, 1945.—The formulae, derived from equations for the axial magnification, relate to central and sagittal rays. The condition for zero spherical aberration is obtained. It is first given in the usual Petzval form with the addition of a corrective term, and a simpler form is also given. An addition equation is derived for the sagittal astigmatism.

535.317.8 : 532.525 2881

Schlieren and shadowgraph equipment for air flow analysis. BARNES, N. F., AND BELLINGER, S. L. *J. Opt. Soc. Amer.*, 35, *pp.* 497–509, *Aug.*, 1945.—A survey of the various techniques used in the Schlieren method for making the flow of air visible. Details of the apparatus and of the various precautions are given. A. H.

535.317.9 : 621.397 : 535.313 *see Abstr.* 2871

535.318 : 771.35 2882

The effective aperture of a photographic objective. KINGSLAKE, R. *J. Opt. Soc. Amer.*, 35, *pp.* 518–520, *Aug.*, 1945.—It is pointed out that for a thick lens there is no simple relation between the ordinary (infinity) *f*-number, and the "effective *f*-number" at any specified object distance. A number of examples illustrating this fact are discussed and it is urged that in these special cases the lenses should be engraved with their effective aperture at a specified magnification and not with the ordinary *f*-number. A. H.

535.32 : 547.21 : 536.42 *see Abstr.* 2977

535.322.4 2883

A simple refractometer of the Jamin type. KUHN, H., AND WHEATLEY, G. A. *J. Sci. Instrum.*, 22, *pp.* 110–112, *June*, 1945.—A modification of the Jamin refractometer is described in which each of the thick glass plates is replaced by two thin plates, separated by steel balls. It is thus possible to construct a refractometer, either for demonstration purposes or for precision work, without the use of high-quality optical components. Even when patent plate glass is used, good fringes can be obtained.

535.327 : 541.654 : 541.68 : 666.1 2884

The stress-optical coefficient of glasses. BALMFORTH, W., AND HOLLAND, A. J. *J. Soc. Glass Tech.*, 29, *pp.* 111–123, *April*, 1945.—A knowledge of

the stress–optical coefficient of glass is necessary in calculations of the internal stresses set up by the application of mechanical force. Earlier measurements are reviewed and the results of new investigations are described, based on 2 groups of glasses, namely, (1) a series in which CaO progressively replaces Na_2O on a molecular basis in a parent glass of the general formula $6SiO_2 . (2 - x)Na_2O . xCaO$, (2) 12 commercial optical glasses containing varying percentages of PbO (7 glasses) and BaO (5 glasses). The progressive replacement of soda by lime in the above parent glass resulted in a small but significant increase in the stress–optical coefficient.

535.327 : 666.221.3 2885

Refractive-index standards of fluorcrown glass. TILTON, L. W. *J. Res. Nat. Bur. Stand., Wash.*, 34, *pp.* 599–608, *July*, 1945.—Refractive-index samples of fluorcrown glass, which provide solid standards in the index range between fused quartz, $n_D = 1{\cdot}458$, and low index silicate crown glass, $n_D = 1{\cdot}51$, are characterized by very low temp. coeff. of index, and thus are especially recommended for use at extreme room temperatures. Data are tabulated for 6 glasses in the temperature range 15°–55°C. Because of surface weathering, repolishings are sometimes necessary to avoid hazy and possibly false critical border lines. In some cases bright bands appear in the dark portion of the refractometer field. These are interpreted as critical-angle phenomena corresponding to decomposition products in the surface layers.

535.33 2886

Spectral analysis of solid substances. EECKHOUT, J. *Nature, Lond.*, 156, *p.* 175, *Aug.* 11, 1945.—A method is developed whereby it is possible to deduce from a single spectral photograph not only the qualitative analysis of a totally unknown mineral powder, but also its *approximate* quantitative composition.

535.33 2887

Emission bands of the fluctuation type in the spectrum of iodine. ASUNDI, R. K., AND VENKATESWARLU, P. *Nature, Lond.*, 156, *p.* 452, *Oct.* 13, 1945.

535.33 : 061.3 2888

Conference on spectroscopy held at the Museum of Science and Industry, Chicago, Illinois. *Rev. Mod. Phys.*, 16, *pp.* 151–324, *July–Oct.*, 1944.—A symposium comprising the following papers: Foreword, Darrow, K. K.; Forbidden lines in the laboratory, Mrozowski, S. [Abstr. 2894 (1945)]; Partial selection rule for sensitized fluorescence, Winans, J. G. [Abstr. 2937 (1945)]; Spectroscopy of organic molecules in the vacuum ultra-violet, Platt, J. R., and Klevens, H. B. [Abstr. 2914 (1945)]; The near ultra-violet absorption of pyridine vapour, Sponer, H. [Abstr. 2913 (1945)]; Spectra of porphyrins and chlorophyll, Rabinowitch, E. [Abstr. 2907 (1945)]; Grating infra-red measurements at oblique incidence. Line width in the spectrum of N_2O, Adel, A., and Barker, E. F. [Abstr. 2900 (1945)]; The infra-red absorption spectrum of deuteromethyl chloride, Nielsen, A. H., and Nielsen, H. H. [Abstr. 2923 (1945)]; Degenerate modes of vibration and perturbations in polyatomic molecules, Shaffer, W. H. [Abstr. 2748 (1945)]; The infra-red spectra of the isomeric octanes in the liquid phase, Oetjen, R. A., Randall, H. M., and Anderson, W. E. [Abstr. 2896 (1945)]; The infra-red spectra of the isomeric octanes in the vapour phase, Oetjen, R. A., and Randa H. M. [Abstr. 2897 (1945)]; Spectra of the plane Bobrovnikoff, N. T. [Abstr. 2697 (1945)]; Rece progress in the interpretation of stellar spectr Struve, O. [Abstr. 2717 (1945)]; The negative ions hydrogen and oxygen in stellar atmospheres, Cha drasekhar, S. [Abstr. 2718 (1945)]; The absorpti laws for gases in the infra-red, Nielsen, J. R., Thor ton, V., and Dale, E. B. [Abstr. 2915 (1945)].

535.33 : 523.4 *see Abstr.* 2697

535.33 : 539.153 *see Abstr.* 3067

535.33–1 : 549.211 *see Abstr.* 3134

535.33–15 : 518 28

Computer for infra-red spectra. FUOSS, R. M., A MEAD, D. J. *Rev. Sci. Instrum.*, 16, *p.* 223, *Aug.*, 19

535.33.07 : 535.825 *see Abstr.* 2969

535.33.072 : 535.375.5 28

A fast grating spectrograph. Accessories a techniques for studying the Raman effect. STAM R. F. *Industr. Engng Chem.* (*Analyt. Edit.*), *pp.* 318–331, *May*, 1945.—The grating employed is 90 000 line 6 in. echelette-type and the dispersi obtained is 37 Å/mm. Details of suitable excitati equipment, filters, etc., are given. The speed sufficient to give Raman spectrograms in a few m The practical details are followed by a survey Raman effect theory and the elucidation of molecu structure together with a discussion of the possi applications in industrial analysis. A.

535.33.072–1 : 537.324 *see Abstr.* 3018

535.335 : 523.87 *see Abstr.* 2717

535.336.2 28

Detection of metastable ions with the mass spectr meter. HIPPLE, J. A., AND CONDON, E. U. *Ph Rev.*, 68, *pp.* 54–55, *July* 1 *and* 15, 1945.

535.336.2 : 545.7 28

Mass spectrometric analyses of hydrocarbon and mixtures. BREWER, A. K., AND DIBELER, V. *J. Res. Nat. Bur. Stand., Wash.*, 35, *pp.* 125–14 *Aug.*, 1945.—The basic principles are outlined. T method of calculating the composition from the ma abundance records is described. Analyses of number of hydrocarbon and other gas mixtures shown. Whenever possible, comparisons w different methods of analyses are given. The rep ducibility and the accuracy obtainable in m spectrometric analyses are described.

535.338 + 535.343 28

Absorption and excitation of zinc silicate phospho CHUNG KWAI LUI. *J. Opt. Soc. Amer.*, 35, *pp.* 4 494, *July*, 1945.—The excitation spectrum of z silicate phosphor showed two bands. A major ba is located between 2 250 Å and 2 900 Å, and a mi one between 1 950 Å and 2 250 Å. Absorpti measurements of clear willemite crystals showe similar bands located at about the same positio Absorption measurements for zinc silicate phosp showed a band located between 2 000 Å and 3 000 These results indicate that the excitation spectrum a phosphor also measures its absorption.

535.338 : 537.531 *see Abstr.* 3029

535.338.3 2

Forbidden lines in the laboratory. MROZOWSKI, *Rev. Mod. Phys.*, 16, *pp.* 153–174, *July–Oct.*, 1944

discussion of newer developments in the field of rbidden radiations, restricted to laboratory results nd their interpretation) for atoms and diatomic olecules. Experimental methods are described, and eory dealt with at length. A. H.

5.338.3 : 523.775.5 *see Abstr.* 2703

5.338.3 : 538.615 2895

Term analyses of the first two spectra of columbium iobium]. HUMPHREYS, C. J., AND MEGGERS, W. F. *Res. Nat. Bur. Stand., Wash.*, 34, *pp.* 477–585, *ne*, 1945.

5.338.3–1 2896

The infra-red spectra of the isomeric octanes in the quid phase. OETJEN, R. A., RANDALL, H. M., AND NDERSON, W. E. *Rev. Mod. Phys.*, 16, *pp.* 260–264, *ly–Oct.*, 1944.—Presents infra-red spectroscopic ta which may serve as standards for analytical rposes, and which may also be of use in the study molecular structure. Data for 17 isomeric octanes the liquid phase are given. A. H.

5.338.3–1 2897

The infra-red spectra of the isomeric octanes in the apour phase. OETJEN, R. A., AND RANDALL, H. M. *ev. Mod. Phys.*, 16, *pp.* 265–270, *July–Oct.*, 1944.—ee Abstr. 2896 (1945)]. Comparable data for the me substances in the vapour phase are given. A. H.

5.338.33 2898

Investigations on the spectrum of bromine. II. Structre of Br II. RAMANADHAM, R., AND RAO, K. R. *dian J. Phys.*, 18, *pp.* 317–322, *Dec.*, 1944.—[See Abstr. 089 (1937)]. The analysis of the spectrum of Br II, ported by Bloch and Lacroute [Abstr. 3718 (1934)], as been confirmed by a close examination of the individual lines forming the various triplet groups. With he aid of some of the known terms, the fundamental iplet giving the ground term $4p^3p$ has been identified the vacuum grating region. The analysis is tended to include new terms, chiefly of the *5d* onfiguration, based on the ^2D state of the ion. ltogether about 100 lines have been newly classified.

5.338.33 2899

First spark spectrum of thorium—infra-red spectrum nd further classification of Th II. MCNALLY, J. R., *J. Opt. Soc. Amer.*, 35, *pp.* 390–398, *June*, 1945.—vestigations of the infra-red spectra of Th were ndertaken in order to establish a correlation between he two previously established but unconnected energy roups in the Th II term structure. Specially sensitized nfra-red plates were exposed in a 35 ft. Wadsworth igmatic grating spectrograph to sparks between etallic Th rods and to high current arcs of thoria in and Cu electrodes. Many strong arc and spark lines ere recorded in the region λ8 665 Å–λ11 230 Å. The esired combination lines were observed and readily stablished the correlation between the two previously istinct groups of levels. The separation of the low evels $^2D_{1\frac{1}{2}}$ (from $6d7s^2$) and $^2F^\circ_{2\frac{1}{2}}$ (from $5f7s^2$) was ound to be only 4 490·29 cm.$^{-1}$. Infra-red quartet ultiplets as well as quartet multiplets involving the ost sensitive lines of Th II are presented and discussed. Tables of infra-red wavelengths and of pectral terms are given.

535.338.334–1 2900

Grating infra-red measurements at oblique incidence. ine width in the spectrum of N_2O. ADEL, A., AND BARKER, E. F. *Rev. Mod. Phys.*, 16, *pp.* 236–240, *July–Oct.*, 1944.—The method of oblique incidence is used to secure the narrow slits essential to the measurement of line widths. The technique has been applied to a number of substances but only N_2O is considered here. The apparent half-widths obtained are of the order of 0·10 cm^{-1}. These values are decidedly smaller than those previously reported for infra-red lines. A. H.

535.338.4 2901

A new band system of the HgBr molecule. RAO, K. R., AND RAO, G. V. S. R. *Indian J. Phys.*, 18, *pp.* 281–284, *Oct.*, 1944.—The system is situated in the ultra-violet between λ2 470 Å and λ2 430 Å, and consists of about 20 bands, which are headless and diffuse. The three sequences $\Delta v = 0$ and ± 1 are identified. The bands are represented by the formula

$$\nu = 40\,720 + [166(v' + \tfrac{1}{2}) - 1\cdot1(v' + \tfrac{1}{2})^2] - [183(v'' + \tfrac{1}{2}) - 2\cdot0(v'' + \tfrac{1}{2})^2]$$

The system is considered to be due to a transition from a higher $^2\Sigma$ state to the lower ground state $^2\Sigma$, determined previously by Wieland.

535.338.4 2902

Explanation of the broadness and other characteristics of association bands. PARSHAD, R. *Nature, Lond.*, 155, *p.* 788, *June* 30, 1945.

535.338.4 2903

Near ultra-violet emission bands of benzene. ASUNDI, R. K., AND PADHYE, M. R. *Nature, Lond.*, 156, *p.* 368, *Sept.* 22, 1945.

535.338.4 : 523.67 : 523.872 2904

Comparative study of the red and violet systems of cyanogen bands. KING, A. S., AND SWINGS, P. *Astrophys. J.*, 101, *pp.* 6–14, *Jan.*, 1945.—Furnace spectrograms of CN (from N_2 gas in a graphite tube) are studied in order to compare the relative intensities of the red and violet systems at various temperatures. In emission, λ3883 (0,0) is weaker than λ7873 (1,0) below 2 300°C. but is somewhat stronger at 2 600°C. In the carbon arc in air (7 300°C.) it is 200 times stronger. In absorption, the bands of the red system are much weaker at all temperatures of the furnace. The relative intensities in emission are explained by the different Boltzmann populations in the upper levels (1·35 V for the red, 3·2 V for the violet system). From the equality of the stronger lines at 2 300°C. the ratio of the emission transition probability for the violet system to that of the red is found to be 1 400. The corresponding ratio in absorption is about 87.5. Accordingly the red system should not appear in fluorescence in comets nor in interstellar absorption. When it does appear in certain carbon stars, the weakness of the violet system is attributed to continuous absorption. A. HU.

535.338.4 : 551.593.52 2905

Infra-red spectrum of the night sky. HERMAN, R., HERMAN, L., AND GAUZIT, J. *Nature, Lond.*, 156, *pp.* 114–115, *July* 28, 1945.—The spectrum was photographed by means of a spectrograph with two prisms having an aperture of $f/1\cdot5$, giving a dispersion of 2 000 Å/mm. near 8 000 Å and of 3 000 Å/mm. near 10 000 Å. A 10 hour exposure at the Lyons Observatory gave a spectrum showing: (1) A broad band without any visible structure, stretching from

λ7 400 Å to about λ8 500 Å. (2) A very broad band at about 0·97 μ and a line or band about 1·03 μ.

535.339 : 537.531 *see Abstr.* 3030

535.34 2906

Intensities of light absorption. BRAUDE, E. A. *Nature, Lond.*, 155, *pp.* 753–754, *June* 23, 1945.—A simple method of attacking the problem of absorption intensity introduces the average effective absorbing area (chromophore area) of the molecules in a plane perpendicular to the incident light. The illumination falling on the absorbing molecules is obtained. Multiplication by the light extinction factor, F, gives the absorbed illumination, and integration gives the molecular extinction coeff. ε. The value obtained for the maximum possible value of ε is the same as the classical value, but F, unlike f (the mean oscillator strength) is an absolute quantity depending only on molecular size and configuration and involves no assumption as to the mechanism of absorption. The observed values of $\varepsilon_{max.}$ are always < the possible max., and explanations of the difference are given. If F is assumed to be 1, or can be estimated, the effective chromophore area can be calculated from the observed value of $\varepsilon_{max.}$ A. J. M.

535.34 2907

Spectra of porphyrins and chlorophyll. RABINOWITCH, E. *Rev. Mod. Phys.*, 16, *pp.* 226–235, *July–Oct.*, 1944.—No new results are presented in this survey article dealing with the spectra of porphyrins and chlorophyll. Biological considerations are dealt with at length. A. H.

535.34 : 535.243 2908

A new method for quantitative extinction measurements in absorption spectra. LUNDEGÅRDH, H., AND STENLID, G. *Ark. Kemi Min. Geol.*, 18*B*, 6, *No.* 11, 8 *pp.*, 1945.—A method is described for the quantitative absorption spectrography of liquids in which the usual logarithmic sector is replaced by a linear (screw) sector such as can be made with a good screw-cutting lathe. A. H.

535.34 : 538.615 2909

On the influence of magnetic field on the absorption spectra of liquids. BANERJEA, A. K. *Indian J. Phys.*, 18, *pp.* 364–368, *Oct.*, 1944.—The width of the absorption band and the intensity of the transmitted light through an absorption cell containing solutions of crystals of $NiSO_4.7H_2O$, $CoSO_4.6H_2O$, $FeCl_3.7H_2O$, $MnCl_2$ and pure liquids like benzene, xylene, etc., was found to change under the influence of moderately strong magnetic fields. In the case of solutions of paramagnetic crystals, it was observed that the intensity of the transmitted light was less with field than without field. In the case of diamagnetic liquids the intensity of the transmitted light was greater with field than without it. The magnetic field was of the order 13 kilogauss.

535.34/.37 2910

On the study of absorption and fluorescence spectra of some aromatic hydrocarbons in solution. GANGULY, S. C. *Indian J. Phys.*, 18, *pp.* 347–349, *Dec.*, 1944.—Effects of the variation of wavelengths of the exciting radiation on the fluorescence were studied. It was found in all cases that the long wavelength limit of the exciting radiation is the longest wavelength of the absorption band of the material.

535.34–1 2911

Silver chloride windows for infra-red cells. FUOSS, R. M. *Rev. Sci. Instrum.*, 16, *pp.* 154–155, *June*, 1945.—A gas cell for infra-red absorption spectra is described. The design permits easy replacement of the AgCl windows, because no cement is used. The transmission is uniformly 80% per window between 3 and 12 μ, independent of window thickness up to at least 2·4 mm.

535.34–31 2912

Absorption spectra of acridines. II. Monoaminoacridines. TURNBULL, N. H. *J. Chem. Soc.*, *pp.* 441–444, *July*, 1945.—It was seen that those isomerides which evinced the greatest biological activity also exhibit the greatest spectrographic individuality. [See Abstr. 2931 (1945)].

535.34–31 2913

The near ultra-violet absorption of pyridine vapour. SPONER, H. *Rev. Mod. Phys.*, 16, *pp.* 224–225, *July–Oct.*, 1944.—A preliminary report on an examination of the near u.v. absorption spectrum of pyridine vapour. According to this analysis the 0,0 band is located at 34 769 cm.$^{-1}$ whilst frequency values of 995 and 968 cm.$^{-1}$ are correlated with the ground state frequencies 1 031 and 992 cm.$^{-1}$ known from Raman spectra. A. H.

535.342–31 : 547 2914

Spectroscopy of organic molecules in the vacuum ultra-violet. PLATT, J. R., AND KLEVENS, H. B. *Rev. Mod. Phys.*, 16, *pp.* 182–223, *July–Oct.*, 1944.—The vacuum ultra-violet region is likely to become of increasing importance. The present position and future possibilities are outlined. Experimental difficulties are discussed and the main features of various set-ups examined. Regularities in observed spectra, and possible applications, are examined. A set of tables gives details of known organic spectra below 2 000 Å. A. H.

535.342–1 2915

The absorption laws for gases in the infra-red. NIELSEN, J. R., THORNTON, V., AND DALE, E. B. *Rev. Mod. Phys.*, 16, *pp.* 307–324, *July–Oct.*, 1944.—Increasing interest in the applications of infra-red absorption spectra to the analysis of mixtures of chemical compounds necessitates a re-examination of the absorption laws holding for different types of infra-red absorption bands, particularly from the view-point of industrial infra-red spectroscopists. The examination is confined to gases and to those cases where collision damping is the chief cause of line-broadening. A. H.

535.342.3–32 2916

Extreme ultra-violet absorption spectra of the fatty acids. RUSOFF, I. I., PLATT, J. R., KLEVENS, H. B., AND BURR, G. O. *J. Amer. Chem. Soc.*, 67, *pp.* 673–678, *April*, 1945.—A study of naturally occurring fatty acids, their isomers and derivatives shows the large effects of the number and position of double bonds, and the smaller effects of geometric isomerism and esterification, on absorption spectra. The absorption of light of very short wavelength depends directly on the fatty acids composition of the oil. W. R. A.

535.343 + 535.338 *see Abstr.* 2893

535.343 2917

Rules for the absorption spectra of dyes. LEWIS, G. N. *J. Amer. Chem. Soc.*, 67, *pp.* 770–775, *May*, 1945.—Triphenylmethane, xanthene, acridine, diphenylamine, oxazine, thiazine, and azine dyes are considered as one family and 2 rules are given for determining the wavelength, λ, of the main absorption band of any one member of the family. The first, theoretical, states that λ is always greater, the greater the fraction of the characteristic positive charge that is on the auxochromes. The second, empirical, states that the effect upon λ of various groups is additive. A number of additive constants have been obtained from which λ can be calculated and the results are all consistent with the theoretical rule except that in the acridine dyes the values obtained are for the second (y) band and not for the first (x) band. The results show that λ can be predicted with an average error of > 3 mμ. W. R. A.

535.343 2918

The absorption spectra of some N-phenyl-*p*, *p*′-diaminotriphenylmethane dyes. TOLBERT, B. M., BRANCH, G. E. K., AND BERLENBACH, B. E. *J. Amer. Chem. Soc.*, 67, *pp.* 887–893, *June*, 1945.—6 dyes were prepared, and their absorption spectra compared with those of malachite green and Dobner's violet. The phenyl group increases the wavelength for both x- and y-bands, but the asymmetry produced by a double phenylation of one N atom decreases the wavelength for both x- and y-bands. An N-methyl group increases the wavelength for both x- and y-bands. The effects are independent of the solvent. W. R. A.

535.343 2919

Studies in light absorption. I. *p*-Benzoquinones. BRAUDE, E. A. *J. Chem. Soc.*, *pp.* 490–497, *Aug.*, 1945.—The selective visible and ultra-violet light absorption of *p*-benzoquinone in several solvents and of 26 alkyl-, methoxy-, halogeno-, and amino-substituted *p*-benzoquinones in *n*-hexane and in chloroform are recorded and discussed.

535.343 2920

Studies in light absorption. II. 2 : 4-dinitrophenylhydrazones. BRAUDE, E. A., AND JONES, E. R. H. *J. Chem. Soc.*, *pp.* 498–503, *Aug.*, 1945.—About 50 dinitrophenylhydrazones were determined in both alcoholic and chloroformic solution. Their absorption properties are dependent upon the extent of the conjugated unsaturation present in the parent carbonyl compound, and alkyl substitution effects were also observed. The classified data provide structural evidence useful in degradative work and are of theoretical interest in connection with the optical properties of the >C : N– and the >NH groups.

535.343 : 535.372 *see Abstr.* 2940

535.343 : 537.531 *see Abstr.* 3031

535.343 : 541.121 : 536.7 *see Abstr.* 3001

535.343 : 541.132.3 2921

The effect of *p*H on the spectra of thymine and thymine desoxyriboside. STIMSON, M. M., AND REUTER, M. A. *J. Amer. Chem. Soc.*, 67, *pp.* 847–848, *May*, 1945.—The spectra of thymine, thymine desoxyriboside and of yeast and thymus nucleic acids are given. Data show that it is not possible to identify pyrimidine-nucleosides or nucleotides from change in spectra with *p*H.

535.343 : 541.651 2922

The infra-red spectra of cresols and xylenols and the analysis of cresylic acid. WHIFFEN, D. H., AND THOMPSON, H. W. *J. Chem. Soc.*, *pp.* 268–273, *May*, 1945.—The infra-red spectra of cresols and xylenols were measured over a wide spectral range. A method for the rapid analysis of cresylic acid, and the basis for similar work on mixtures of xylenols are described. Correlations of the spectra with molecular structure, and the effect of the substituent groups on a vibration frequency of benzenoid substances are considered. The possibility of formulating general rules by which *o*-, *m*-, and *p*-derivatives may be distinguished regardless of the particular substituents is considered, and similar considerations are applied to trisubstituted benzenes. A peculiarity in the spectra of some of the phenolic compounds is discussed in relation to molecular association.

535.343–15 2923

The infra-red absorption spectrum of deutero-methyl chloride. NIELSEN, A. H., AND NIELSEN, H. H. *Rev. Mod. Phys.*, 16, *pp.* 241–244, *July–Oct.*, 1944.—A preliminary report on the infra-red absorption spectrum of CD_3Cl obtained by means of an automatically recording prism spectrograph and also a prism-grating spectrometer of moderate resolving power and dispersion. The regions examined are 4·2–4·6 μ, 9·0–10·0 μ, and 13·0–15·0 μ. The results are compared with those for CH_3Cl. A. H.

535.343–15 : 553.94 2924

Infra-red spectra of coals. CANNON, C. G., AND SUTHERLAND, G. B. B. M. *Nature, Lond.*, 156, *p.* 240, *Aug.* 25, 1945.—[See Abstr. 1413 (1945)].

535.343–31 2925

The absorption spectra of the vitamins and provitamins D. HUBER, W., EWING, G. W., AND KRIGER, J. *J. Amer. Chem. Soc.*, 67, *pp.* 609–617, *April*, 1945.—The ultra-violet absorption spectra of several nitrobenzoic esters of the provitamins and vitamins D_2 and D_3 were determined and compared with the spectra of the corresponding free sterols and acids and also the cyclohexyl esters of the same acids. The comparisons were made by a graphical subtraction method.

535.343–31 2926

The absorption spectra of triple bond molecules in the vacuum ultra violet. PRICE, W. C., AND WALSH, A. D. *Trans. Faraday Soc.*, 41, *pp.* 381–388, *July*, 1945.—The spectra of acetylene, methyl acetylene, hydrogen cyanide, diacetylene, dimethyl diacetylene and cyanogen were photographed in the vacuum ultra-violet. 2 long Rydberg series were found for methyl acetylene, leading to the limits 11·2590 ± 0·0005 and 11·2417 ± 0·001 V. 2 well-developed Rydberg series in diacetylene lead to the value 10·741 V. for the first π ionization potential of the molecule. In dimethyl diacetylene the second ionization potential of the π electrons is found to be 11·45 V. Discussions of all the spectra in terms of the electronic structures are given.

535.343.1 : 523.872 : 530.145.6 2927

The continuous absorption of light by negative sodium atoms. HUANG, K. *Astrophys. J.*, 101, *pp.* 196–203, *March*, 1945.—An analytical expression fitting the numerical wave function for Na^- is used

in calculating the continuous absorption coefficient of the ion as a function of frequency. It is shown that errors committed by ignoring the distortion of the plane wave by the atomic field are negligible, and the free electron solution is used for the wave function of the ejected electron. Cross-sections for the reverse process (capture of electrons by Na atoms) are tabulated. A. HU.

535.343.2–15 + 535.375.54 *see Abstr.* 2944

535.343.3–15 : 545.8 2928

Quantitative liquid phase hydrocarbon analysis by infra-red absorption. GORDON, R. R., AND POWELL, H. *J. Inst. Petrol.*, 31, *pp.* 191–212, *July*, 1945.—An attempt is made to evaluate cell zero, the effect of scattered radiation of short wavelengths, and the variations of absorption with thickness of absorbing material, on a quantitative basis, with the object of removing the individuality among published spectra. The advantages of using a variable thickness absorption cell for this purpose are demonstrated. Its application to the analysis of mixtures containing 5 hydrocarbons is discussed. The method of computation and a numerical example of the application of the corrections are given.

535.343.3–31 2929

The absorption spectra of acrolein, crotonaldehyde and mesityl oxide in the vacuum ultra-violet. WALSH, A. D. *Trans. Faraday Soc.*, 41, *pp.* 498–505, *Aug.–Sept.*, 1945.—Photographs of the spectra are given. Three well-developed Rydberg series are found for acrolein leading to a conspicuous ionization potential at 10·057 ± 0·06 V. Below 1 900 Å the spectra are dominated by the bands due to absorption by the $2p_y$ oxygen lone pair electrons. The electronic structures of the molecules are formulated and an assignment of the various possible transitions suggested. This supports an assignment previously suggested for the transitions in the acetaldehyde spectrum. The spectrum of mesityl oxide is briefly described.

535.343.32 2930

The effect of molecular environment on the absorption spectra of organic compounds in solution. IV. Dienones and dienals. EVANS, L. K., AND GILLAM, A. E. *J. Chem. Soc.*, *pp.* 432–436, *July*, 1945.—The absorption spectra of various conjugated dienones and dienals were studied. It is found that in all the known cases the absorption band lies between 2 690 and 3 170 Å, depending on the number and position of the alkyl substituents, for, as in the case of the $\alpha\beta$-unsaturated ketones, each successive alkyl substituent on the chromophore exerts a tendency to displace the absorption band by approximately 100 Å towards longer wavelengths. Data on the corresponding semicarbazones and phenylsemicarbazones are given. [Abstr. 159 (1944)].

535.343.32–31 2931

Absorption spectra of acridines. I. Some aminoacridines. CRAIG, D. P., AND SHORT, L. N. *J. Chem. Soc.*, *pp.* 419–422, *June*, 1945.

535.343.4 = 3 2932

The structure of the Huggins-band for ozone. MELCHER, D. *Helv. Phys. Acta.*, 18, 1, *pp.* 72–78, 1945.—The Huggins-band system of O_3 was measured, the results compared with those of Chalonge and the validity of Kondratjew's formula as applied to presen and earlier measurements was examined.

535.343.4–3 293

The near ultra-violet absorption spectrum of pheno vapour. MATSEN, F. A., GINSBURG, N., AND ROBERT SON, W. W. *J. Chem. Phys.*, 13, *pp.* 309–316, *Aug.* 1945.—As observed with a 3m. grating spectrograp it consisted of 330 bands. A tentative analysis i made on the basis of the fundamental ground-stat frequencies 245, 397, 527, 811, 824 and 999 and th fundamental excited-state frequencies 208, 374, 476 562, 783, 935, 975, 1274 and 1565. These agree wel with Raman data.

535.345 : 551.463 293

Daylight and its penetration into the sea. ATKINS W. R. G. *Trans. Illum. Engng Soc., Lond.*, 10 *pp.* 133–143, *July*, 1945.—Describes measurements o daylight illumination, both that on a horizontal sur face and the total at a point as obtained with a diffusing globe over a photocell. A curve is given showing the total light received, in kilolux-hours during each month of the year at Plymouth. The submarine photometer used for under-water measure ments is described and curves are given showing the reduction in illumination at various depths below sea level. The application of the results in the study o marine biological problems is explained. J. W. T. W

535.348 : 548.0 *see Abstr.* 3121

535.371–31 : 544.65 293

Diagnostic characteristics of crude oil: fluorescenc analysis in ultra-violet light. MUKHERJEE, J. N., AN INDRA, M. K. *J. Inst. Petrol.*, 31, *pp.* 173–178, *June* 1945.—A combination of spot tests and capillary analysis with filter paper gave an easy and fairly rapid method of distinguishing between refined oil samples crude samples, artificial crudes, and an extract o resin. The intensity of fluorescence as determine by the amount of nitrobenzene needed to quench fluorescence, is different for different oils, and for the true and artificial crudes. Results suggest a simple means of testing whether supposed oil seepages o oil-shows in the mud returns of an exploratory wel are genuine. The method also suggests ways o making a reliable test of samples collected during geological mapping or obtained by coring, when it i desired to know if traces of oil are present. N. M. B

535.372 293

The theory of the influence of concentration on the fluorescence of solutions. VAVILOV, S. I. *J. Phys USSR*, 7, 4, *pp.* 141–152, 1943.—A quantum mechanical resonance, leading to a migration o energy, is assumed to exist between the excited and non-excited molecules. When the distance between the latter is great the energy exchange leads to depolarization but when the distance is small there i a considerable resonance coupling between the molecules, and a quenching of the fluorescence Formulae are developed, on the basis of this theory for the yield, the degree of polarization and the life time of the excited state. These are checked by experiment. L. S. G

535.372 293

Partial selection rule for sensitized fluorescence WINANS, J. G. *Rev. Mod. Phys.*, 16, *pp.* 175–181 *July–Oct.*, 1944.—Experiments are described giving

ormation on the conditions under which excitation ergy may be passed from one molecule to another collision. Experiments were carried out for xtures of Hg vapour with Cd, Pb, In, Ag, Na, and Bi. A. H.

5.372 2938

The fluorescence of naphthacene in anthracene. WEN, E. J. *J. Chem. Phys.*, 13, *p.* 306, *July*, 1945.—[See Abstr. 2250 (1945)].

5.372 2939

Fluorescence of dipropyl ketone at low temperatures. KAR, S. C., AND BISHUI, B. M. *Nature, Lond*, 156, 333–334, *Sept.* 15, 1945.

5.372 : 535.343 2940

Phosphorescence in fluid media and the reverse process of singlet-triplet absorption. LEWIS, G. N., AND KASHA, M. *J. Amer. Chem. Soc.*, 67, *pp.* 994–1003, *June*, 1945.—The quasi-forbidden absorption bands (singlet-triplet, or S-T, transitions), corresponding to the emission bands of phosphorescence were investigated. These new bands differ markedly from the ordinary bands of absorption, which involve only singlet-singlet transitions, and they satisfy 6 criteria which deal with their position and width, with the separation of their vibrational structure, and with the intensity of absorption. A thermodynamic equation was derived enabling the intensity of absorption to be calculated from the life time of the corresponding phosphorescence emission. This equation should, theoretically, be valid for any absorption, and corresponding emission, when the bands are narrow and single, but need not be so with the broad and multiple bands characteristic of the absorption and luminescence of organic molecules. Using values of the fluorescent lives of rhodamine B and fluorescein the equation was applicable within a factor of approx. 2. The abnormal colours of thioketones and nitroso compounds is attributed to S-T absorption, the phosphorescent life being short. 4 nitroso compounds were investigated, and their S-T absorptions satisfy most of the criteria of such transitions. [See Abstr. 1425 (1945)]. W. R. A.

535.372 : 548.7 2941

Fluorescence of naphthalene crystals. OBREIMOV, J. V., AND SHABALDAS, C. G. *J. Phys. USSR*, 7, 4, *p.* 168–178, 1943.—The fluorescence spectrum was photographed at 20°K. It is similar to the resonance spectrum of gases. 4 electron transitions were found, the frequencies being 370 cm.$^{-1}$, 1 070 cm.$^{-1}$, 1 150 cm.$^{-1}$ and 1 420 cm.$^{-1}$ Nearly all the Raman frequencies and a few non-Raman vibrational frequencies were detected. L. S. G.

535.375.5 2942

Raman spectrum of the deuterohydroxylammonium ion. REDLICH, O., AND FRIEDMAN, I. I. *J. Amer. Chem. Soc.*, 67, *pp.* 893–894, *June*, 1945.—Raman spectra of H_3NOH^+ and D_3NOD^+ were measured and interpreted. Both compounds give several bands, some very broad lines, and only one sharp line, at 1005 and 987 cm.$^{-1}$ respectively. W. R. A.

535.375.5 : 535.33.072 *see Abstr.* 2890

535.375.5 = 4 2943

Raman spectra of *cis* and *trans* 3-*ol*-1 hexene. SUSZ, B. P. *Arch. Sci. Phys. Nat.*, 26, *Nov.–Dec.* (*Suppl. No.* 3, *C.R. Soc. Phys. Hist. Nat., Genève*, 61, 3, *pp.* 237–241), 1944.

535.375.54 + 535.343.2–15 2944

Raman and infra-red spectra of rock-salt. KRISHNAN, R. S. *Nature, Lond.*, 156, *p.* 267, *Sept.* 1, 1945.

535.376 2945

The mechanism of luminescence of phosphors. I–II. ANTONOV-ROMANOVSKIJ, V. V. *J. Phys. USSR*, 6, 3–4, *pp.* 120–140, 1942, *and* 7, 4, *pp.* 153–167, 1943.—It is shown that the luminescence of a phosphor KCl + Tl is of a recombination character, the decay proceeding in the later stages according to a simple bimolecular reaction and the intensity of the luminescence diminishing according to the law $J = pn_0^2(1 + pn_0t)^{-2}$. A detailed analysis of the decay mechanism is carried out. The theory is based on the small magnitude (of the order of the lattice constant) of the displacement of a thermal electron of the phosphor between 2 consecutive trappings. The shape of the decay curve and its dependence on conditions of excitation and decay are explained. An estimate is made of the diffusion coefficient and the mobility of the electrons. The possibility of a monomolecular decay process and of spontaneous radiation in the initial stages of the process are shown. The proposed theory differs essentially from previous theories based on the Bloch–Wilson model of a semiconductor [Abstr. 2759 (1937)]. L. S. G.

535.379 : 543.86 2946

Application of the chemiluminescence test for haematin to plant tissues. COMMON, R. H. *Nature, Lond.*, 155, *p.* 604, *May* 19, 1945.

535.415 2947

A new interference effect. BAUCHWITZ, F. K., AND SHOENBERG, D. *Nature, Lond.*, 156, *p.* 142, *Aug.* 4, 1945.—In the production of Haidinger fringes by the illumination of a thin film between silvered surfaces, coloured circular fringes were observed when white light illumination was used. The fringes are not influenced by lack of accurate parallelism of the silvered surfaces. The sharpness improves with increase of the reflection coeff. of the surfaces. The effect is explained by supposing that the fringes are formed by light which has been multiply reflected at an angle θ, then scattered, and again multiply reflected at an angle ϕ. A formula deduced on this basis gives qualitative agreement with the experimental data. A. J. M.

535.417 : 539.211 : 548 2948

New contributions to interferometry, with applications to crystal studies. TOLANSKY, S. *J. Sci. Instrum.*, 22, *pp.* 161–167, *Sept.*, 1945.—Describes new techniques using only visible light but capable of measuring molecular dimensions; low order multiple-beam interference is used. By evaporating silver on to the surface under test and also on to a high grade quartz optical flat, and examining in detail the fringe system produced by the two surfaces when suitably illuminated, the topography of the surface under test can be studied with great accuracy. White or monochromatic light can be used. The new methods described represent a considerable advance on previous technique. In particular, the analysis of elliptically polarized light is facilitated. N. C.

535.42 : 537.531 : 539.4 *see Abstr.* 3087

535.42 : 669.74 : 537.531 *see Abstr.* 3032

535.421.01 2949

The theory of the concave grating. BEUTLER, H. G. *J. Opt. Soc. Amer.*, 35, *pp.* 311–350, *May*, 1945.—The general theory of the image formation of the concave grating, based on Fermat's principle, is developed, particularly from the view point of adjustment. The topics discussed include the conditions for a focus, the grating equation, mounting, focusing conditions and imperfections for the various mountings, astigmatism, curvature and broadening of the spectral lines. A. H.

535.51 : 666.1 : 620.171.5 2950

A projection type of strain-viewer. FORTEY, J. *J. Soc. Glass Tech.*, 29, *pp.* 124–127, *April*, 1945.—[Abstr. 2354 B (1945)].

535.515 : 537.228.3/.4 = 3 *see Abstr.* 3012

535.55 2951

A photographic method of deriving isoclinics in photo-elastic methods. DUNN, B. *Nature, Lond.*, 156, *p.* 480, *Oct.* 20, 1945.

535.55 : 532.517.2 2952

Studies on double refraction of flow. II. The molecular dimensions of zein. FOSTER, J. F., AND EDSALL, J. T. *J. Amer. Chem. Soc.*, 67, *pp.* 617–625, *April*, 1945.—The theory of double refraction of flow and its application to the determination of molecular length is reviewed. The results obtained for the relatively short corpuscular protein zein in an apparatus capable of velocity gradients of 30 000 sec.$^{-1}$ using the technique of high viscosity solvents, agree with sedimentation, diffusion and viscosity measurements on this protein when compared on the basis of a prolate ellipsoidal molecule roughly 300–400 Å in length. W. R. A.

535.55 : 532.517.2 2953

Some observations on the method of measuring streaming double refraction. SNELLMAN, O. *Ark. Kemi Min. Geol.*, 19*A*, 6, *No.* 30, 10 *pp.*, 1945.—In discussions of flow birefringence the experimental procedure is frequently overlooked. There are numerous sources of error which are liable to introduce double refractions of the same order as those being measured. Polarization at lenses or by reflection from metal surfaces must be avoided and this calls for specially designed optical systems. The work of Björnstahl, and Snellman and Björnstahl, is discussed in this connection. Other sources of error are strain in the cover-glasses through which the light passes out from the liquid, and the effect of heat which is developed with liquids of high viscosity. Frey-Wyssling has suggested a method for handling the first of these errors and Björnstahl has worked out the theory for the double refraction produced by frictional heat. The problem of turbulence and its effect on the results has not yet been solved. E. H. D.

535.55 : 532.517.2 = 3 2954

Measurement of flow birefringence of some nucleic acids. SNELLMAN, O., AND WIDSTRÖM, G. *Ark. Kemi Min. Geol.*, 19*A*, 6, *No.* 31, 5 *pp.*, 1945.—The flow birefringence of nucleic acids is measured by observing the state of a liquid confined between a fixed outer and a rotating inner cylinder. The double refraction is due to the orientation of the particles of varying dimensions. For an artificially produced crystal the position of the axes of symmetry relative to the direction of rotation determines the birefringence. A formula is given for the angle between the axis of symmetry and the direction of rotation, and the necessary data are obtained from experiments on highly polymerized substances in the ultracentrifuge. The preparation of thymonucleic acid by several methods is briefly discussed and the effect on structure and, therefore, on the birefringence is considered. E. H. D.

535.551 : 541.18 : 532.517.3 *see Abstr.* 2785

535.6 2955

Colour. WHITE, G. S. J., AND VICKERSTAFF, T. *J. Soc. Dy. Col., Bradford*, 61, *pp.* 213–224, *Sept.*, 1945.

535.62 : 537.54 = 4 2956

Coloration of fluorescent tubes and production of white light. DÉRIBÉRÉ, M. *Bull. Soc. Franç. Élect.*, 5, *pp.* 28–36, *Jan.*, 1945.—Gives spectral energy distribution curves for 3 fluorescent tubes, daylight, white and warm white. The first is stated to be a good approximation to daylight for use where colour distortion is to be avoided. A number of different colours were viewed under different lights and the effects are tabulated. J. W. T. W.

535.642 2957

Analytical representation of trichromatic data. MOON, P., AND SPENCER, D. E. *J. Opt. Soc. Amer.*, 35, *pp.* 399–427, *June*, 1945.—Gives analytical expressions for the 3 distribution coefficients in the C.I.E. colorimetric system and shows how these can be used for integration in place of the tabulated data. A number of new names are proposed for different units. J. W. T. W.

535.65 : 535.215 : 612.11 2958

A simplified photo-electric colorimeter for blood analysis. ANDREWS, H. L., AND HORECKER, B. L. *Rev. Sci. Instrum.*, 16, *pp.* 148–152, *June*, 1945.—A plastic block forms the mounting for the light source, absorption cell, filters, and the photo-cell, the whole comprising a small and rigid unit. The instrument determines methaemoglobin, carbonyl-haemoglobin, and total haemoglobin, based on the spectral absorption of the haemoglobin derivatives in the near infra-red between 7 000 and 10 000 Å. N. M. B.